Report No. PTR-34a



INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

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# THIRD RAILWAY PROJECT

## KOREA

March 27, 1970

Transportation Projects Department

## Currency Equivalents

| | | | | 1967-68 | 1969 | 1970-71 |
|---|---|---|---|---|---|---|
| Currency Unit | | = | Won | | | |
| US$ | 1.00 | = | Won | 265 | 290 | 305 |
| Won | 1 | = | US$ | 0.0038 | 0.00344 | 0.00328 |
| Won | 1,000,000 | = | US$ | 3800 | 3448 | 3278 |

## Fiscal Year

January 1 to December 31

## Units of Weights and Measures

Tons are metric tons (2,205 lb)

1 kilometer (km) - 0.621 mile

## Acronyms and Abbreviations

| | |
|---|---|
| CAH | - Committee Ad Hoc for Planning Overall Transport Measures |
| CTC | - Centralized Traffic Control |
| EPB | - Economic Planning Board |
| EPC | - Economic Plan Committee |
| KFX | - Korean Foreign Exchange |
| MAF | - Ministry of Agriculture and Forestry |
| MOC | - Ministry of Construction |
| MOCI | - Ministry of Commerce and Industry |
| MOF | - Ministry of Finance |
| MOHA | - Ministry of Home Affairs |
| MOT | - Ministry of Transportation |
| OECF | - Overseas Economic Co-operative Fund |
| OSROK | - Government Buying Agency |
| TCC | - Transportation Coordination Committee |
| TCMC | - Transport Co-ordination Ministers Conference |
| TCO | - Transport Co-ordination Office |

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## THIRD RAILWAY PROJECT

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This Appraisal Report has been prepared by Messrs. Chapman (financial analyst), Blumstein (railway engineer), Bronfman (economist) and Dickenson (telecommunication engineer), and has been edited by Miss V. Foster.

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THIRD RAILWAY PROJECT

SUMMARY AND CONCLUSIONS

i. The proposed project, costing an estimated US$156 million equivalent, consists of the last two years of the Korean National Railroad's (KNR) US$310 million 1967-1971 Development Plan. The proposed loan of US$40 million equivalent and IDA Credit of US$15 million equivalent would finance about 70% of the foreign exchange costs of the project. This would be the third Bank Group lending for KNR; the earlier years of the KNR 1967-1971 Development Plan received the support of a 1967 IDA Credit of US$11 million equivalent (Credit 110-KO). The first Bank Group lending for KNR was in 1962 (Credit 25-KO) and amounted to US$14 million equivalent.

ii. The extremely rapid expansion of production in Korea in recent years has placed severe pressure on the transport system. Following the recommendations of a Bank financed transportation survey, Government investment in transport has greatly increased, reaching in 1967 nearly three times the level of 1965, and accounting for 28% of domestic fixed capital formation, but it is clear that unless there is further substantial investment in transport capacity, the present growth of the economy cannot be maintained. KNR has been forced to increase significantly the magnitude of its original 1967-1971 investment plan which was appraised as the basis for Credit 110-KO. Substantial expansion of investment is also taking place in road transport which is seriously underdeveloped and needs attention. In addition to the IDA credits for the railway mentioned above, the Bank Group in 1968 made a credit of US$3.5 million (S4-KO) for highway feasibility studies and engineering and for a study of transport organization and coordination.

iii. In spite of the rapid growth in road transport, the economy continues to rely heavily on railway services, particularly for the transport of production inputs such as fuels, minerals, building materials and fertilizers, and for the increasing movement of grains that has accompanied urbanization and industrialization. The KNR investment plans are primarily designed to increase capacity to meet these rapidly growing traffic demands.

iv. The main items of the proposed project include motive power and rolling stock (48%), increase in station and line capacity (30%) track renewals (11%) and improvement of telecommunications (5%). The proposed loan/credit would finance specific goods procured through international competitive bidding: 50 diesel locomotives, 2,740 freight cars, telecommunications equipment, mechanized track maintenance equipment and consulting services. The total foreign exchange component of the project amounts to an estimated US$83.7 million equivalent. This is to be financed by the proposed loan and credit totalling US$55 million, bilateral and other assistance totalling US$18.7 million, with the remaining US$10.0 million being purchased from Korea's foreign exchange (KFX) reserves by KNR from

its Won cash resources. Should local Korean firms win contracts for constructing freight cars, disbursements from the proposed loan/credit would be made against the total costs of such cars, including a local cost component of about 50%. If Korean firms were to win contracts for all the freight cars, about US$15 million of the US$30 million loan/credit funds disbursed against these contracts would be available to cover, in effect, the US$10 million foreign exchange gap referred to above, allowing a maximum net contribution from the loan/credit of up to US$5 million toward the finance of the local currency costs of the project.

v. The proposed project is based on KNR proposals to expand the 1967-1971 investment plan beyond that appraised as a basis for Credit 110-KO. A number of changes have been made from KNR's proposals and were agreed during negotiations.

vi. A major problem in Korea is that the investment criteria in general use and the local expertise in investment analysis are not adequate relative to the size and urgency of investment needs. There exists the clear danger of waste in the use of scarce resources due to inadequate analysis of alternatives. The consultants' study financed under Credit S4-KO of the organization, staffing needs and criteria of the decision-making bodies in the transport field is nearing completion; during negotiations it was agreed that by December 31, 1970, an appropriate plan for reforms will be drawn up. The implementation of these reforms will be an important complement to the project. Also included in the project are a number of consultants' studies in important areas of railway operations to help determine the optimum pattern of railway investment.

vii. The management of KNR is generally sound, although the measure of KNR autonomy from Government controls envisaged under Credit 110-KO has not been fully achieved. During negotiations agreement was reached on measures to effect some improvement in freedom on accounting and budgeting procedures. The efficiency of operations is high and has generally improved in response to the increasing pressure of traffic demand. Maintenance of property and equipment is satisfactory.

viii. The project as defined in this report has been found to be technically and economically sound. The financial position of the railroad is sound (a rate of return of 4.4% was earned in 1968) and the outlook is good - a return of over 7% is expected from 1971 onwards. The economic rates of return on the items to be financed by the proposed loan/credit average 20%.

ix. The proposed project provides a suitable basis for a Bank loan of US$40 million equivalent for a term of 25 years, including a four-year period of grace, and an IDA Credit of US$15 million equivalent, to the Republic of Korea. The loan and credit would be passed on to KNR as beneficiary on terms identical to those of the loan.

# KOREA

# THIRD RAILWAY PROJECT

## I. INTRODUCTION

1.01 The Government of the Republic of Korea and the Korean National Railroad (KNR) have asked the Bank for a loan of US$40 million equivalent, and the Association for a credit of US$15 million equivalent, to finance part of the foreign exchange cost of KNR's investments during the last two years of the Second Five-Year Economic Development Plan of Korea, 1967-1971. KNR's investments during these two years are estimated at Won 47.5 billion (US$156 million equivalent) with a foreign exchange component of US$83.7 million equivalent. As in previous Bank Group lending operations for KNR, the proposed loan/credit would finance specific imported goods; other foreign requirements would be covered by various bilateral arrangements and from the Government's own foreign exchange resources which would be bought by KNR from its Won balances.

1.02 The Bank Group has helped finance two previous railway projects in Korea. Both were IDA Credits, 25-KO for US$14.0 million equivalent in 1962 and 110-KO for US$11 million equivalent in 1967. Performance on both of these projects has generally been satisfactory. Rolling stock procured under the last credit is already in service and consultants - Touche, Ross & Co. (Canada) - required to examine and advise on certain aspects of working, are now in the field. The only other Bank Group lending for transportation in Korea has been a technical assistance credit, S4-KO, for US$3.5 million equivalent made in 1968 for highway feasibility studies and detailed engineering, transport coordination and a highway organization study.

1.03 This appraisal is based on information supplied by the Government of Korea and the Korean National Railroad and on the findings of a Bank mission in May 1969, comprising Messrs. Chapman (financial analyst), Blumstein (railway engineer), Bronfman (economist) and Dickenson (telecommunication engineer). This report was prepared by them and edited by Miss V. Foster.

## 2. BACKGROUND

### A. Economic Setting

2.01 Economic growth has been impressive in Korea during recent years. The growth rate of real GNP increased from an annual average of 7% during 1962-1964 to 10.4% during 1965-1966; and, in spite of droughts in the last two years, real GNP grew by 9% in 1967 and 13% in 1968, largely because of the very high growth rate of the industrial sector. According to the findings of the most recent Bank Economic Mission, GNP grew by 15.5% in 1969 and is expected to grow by 10% annually in the following three years; a long-term average annual growth level of 9% is forecast.

2.02 The population in mid-1968 was approximately 30.5 million, representing a density of 300 per $km^2$, higher than that of Japan (270) but less than that of Taiwan (360). Per capita GNP increased appreciably from $118 in 1962 to about $190 in 1969. This level, however, is still below that of almost three-fifths of the developing countries. In the last decade, with the vigorous implementation of family planning, the rate of population growth has slowed from 3.0% to 2.2% and it is expected that the short-term target of 2% population growth of 1971 will be reached. There has been a distinct trend toward urbanization as well as industrialization. During 1960-1966, the urban population grew at 6% annually, as opposed to a rural growth rate of only 1.3%. Approximately 15% of the country's population is concentrated in the capital city of Seoul and its immediate surroundings.

2.03 The bulk of investment in recent years has been in the manufacturing sector and associated infrastructure; generally there has been an emphasis on production for export. Merchandise exports increased from a level of less than $90 million in 1962-1964 to almost $670 million in 1969. Two-thirds of exports by value are now contributed by manufactured products; manufacturing and mining outputs increased by 26% in 1968 and now account for a quarter of GNP. With respect to producer goods, production of fuels, cement, electrical machinery and appliances, electronics, chemicals and petrochemicals show the fastest growth.

2.04 Agriculture, forestry and fishing accounted for 29% of GNP in 1968. Agricultural development has gradually been gaining momentum and, beginning in 1969, the Government is increasing considerably its investment allocation to that sector and is promoting fertilizer inputs. Rice and barley are the most important agricultural products and constitute the staple diet of the population. Livestock production and the production of cereals for market have increased considerably as a result of rising urban demand and Government promotion.

## B. The Transport Sector

2.05 The extremely rapid expansion in production has placed severe pressures on the transport system. Additional facilities are particularly needed to carry the heavy inputs for production such as coal, petroleum products, fertilizer and cement and to move grain from its source in rural areas to the cities. In recent years the output of the transportation sector has been growing at a faster pace than GNP and has required substantial investment in transport. Annual public investments in transportation increased threefold during the period 1965-1967, reaching 28% of total domestic fixed capital formation. Nevertheless, Korea's transportation sector contributes only 4% to GNP and continues to be a bottleneck to economic development. Table 1 shows the movement of freight and passengers over all transportation modes in Korea since 1958; it indicates an increase of 14% p.a. in freight handling and of 15% p.a. in passenger traffic between 1958 and 1967. In spite of a rapid growth in traffic by road, the railroad continues to be the predominant mode, with 77% of ton-km and 44% of pass-km.

2.06 In 1966, the country had 34,500 km of roads of which only 1,930 km or 5.6% were paved. In line with the recommendations of a Bank-financed Transportation Survey 1/, the Government in 1968 greatly increased the allocations for highway construction (from W 2.1 billion in 1967 to W 15.6 billion in 1968 and W 21.6 billion in 1969). However most of these funds were allocated to the construction of the Seoul-In Cheon and Seoul-Pu San four-lane toll expressways which may be economically premature. Under an IDA Technical Assistance Credit (S4-KO of July 1968 for US$3.5 million), feasibility studies are being carried out by consultants 2/ for high priority roads totalling about 800 km, out of which about 400 km are to be selected for detailed engineering. The motor vehicle fleet increased from 38,000 in 1964 to over 74,000 in 1968, an annual increase rate of 18% (Table 2). During 1963-1967, road motor vehicle traffic increased annually by 16% for passengers and 11% for freight. Despite this growth, the present vehicle fleet is equivalent to an average of only one vehicle for 430 persons as compared with one for 190 in Thailand and one for 120 in the Philippines. The supply of road transport vehicles in the past has been curtailed by import restrictions designed to conserve foreign exchange. These restrictions are now being relaxed and local assembly plants are beginning to supply the domestic market. The shortage of trucks, which are mainly engaged in short-haul traffic, contributes at least as much to the developing transportation bottlenecks as the lack of roads.

2.07 With foreign and domestic trade increasing rapidly, there has been a growing demand for ocean and coastal shipping. Tonnage handled by ports has increased considerably, mainly because of grain imports. Coastal shipping traffic trebled since 1965 because of diversion (at high cost) of fuel and cement from the overburdened railroad system.

2.08 Air traffic remains comparatively small and is carried by the privately-owned Korean Air Lines (KAL) which provides limited domestic and international flights.

C. Transport Coordination

2.09 The growth of transport requirements and the present evolution from a virtual single mode (railroad) to a multimode transport system make transport planning and coordination an increasingly important issue. Under IDA Technical Assistance Credit S4-KO, consultants 3/ have examined the present Government organization and agencies dealing with transport infrastructure and reviewed the pricing and regulation practices with regard

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1/ Korea Transportation Survey - December 1966 by consultants BCEOM (France) NEDECO NEI (Netherlands) and SOFRERAIL (France).

2/ INGEROUTE (France) and the joint venture Amman and Whitney International Ltd. and Trans/Asia Engineering Associates Inc. (USA).

3/ BCEOM (France) and NEDECO (Netherlands).

to transport services. The consultants' Draft Final Report is currently being reviewed by the Government and the Bank. A Final Report is expected by April 1970. Three matters in the Report are directly or indirectly related to KNR and the proposed project:

Government policy toward transport investment;
KNR's pricing policy; and
Government restrictions on rail traffic.

(i) Government Policy toward Transport Investments

2.10 The Korean Government has initiated a short-term policy aimed at a rapid expansion of highway capacity without sufficient regard to long-term objectives. Also, in some cases substantial investments have been decided before alternative solutions had been thoroughly explored. This situation is to some extent due to the lack of coordination between the various Government departments and agencies dealing with transportation. A summary of the distribution of responsibility is given in Annex 1. The consultants in their draft report recommend control of rates and fares as a basic coordination instrument. This is at variance with the idea, propounded by them and supported by the Association, that supply and demand for transport services should meet, as freely as possible, in open and fair competition. Also, while agreeing that concentration of all main transport activities under one ministry should be the objective (which is also in line with the conclusions of the 1966 Transportation Survey of Korea), their recommendation is to add three more bodies, a Transport Coordination Ministers Conference (TCMC), a Transport Coordination Office (TCO), and a Transport Coordination Working Group, to the already crowded chart of the Government. The Association has expressed its reservations concerning these recommendations to the Government. However, early in 1970 and without previous consultation, the Government appointed the TCMC and created and staffed the TCO. The latter has been placed under the MOT which has only partial authority over transport planning 1/. These arrangements are unsatisfactory. The consultants are now preparing a final report in the light of comments received. During negotiations it was agreed that after receiving the consultant's Final Report, the Government and the Bank will discuss and agree by no later than December 31, 1970 on the measures, and a time phased program for their implementation, necessary to achieve adequate transport coordination, particularly with respect to establishing an effective body for over-all planning of the transport sector.

(ii) KNR's Pricing Policy

2.11 Although freight rates are held at a low level as a matter of Government policy, freight revenues presently cover variable costs and make a sizeable contribution to covering overheads. Passenger fares have been raised to a relatively higher level, and passenger revenues not only cover fully distributed costs, but also enable KNR to provide funds

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1/ MOC retains authority over planning for Highways and Ports.

for investment. In view of the rapid growth of road transport, KNR's dependence upon passenger services to meet desirable revenue targets may prove increasingly infeasible. The railways must give early consideration to pricing policies that will maintain financial viability in the coming competitive environment. Proposals to adjust the situation are discussed in paragraph 6.05.

(iii) Government Restrictions on Rail Traffic

2.12 To reduce the heavy demand on railroad services the Government recently decided to prohibit freight traffic (except coal) by rail over distances of less than 50 km (100 km for fertilizers). At these short distances it is doubtful that present railway rates cover the economic costs involved. When freight rates are revised on the basis of costs, the need for these restrictions should disappear. Agreement has been reached during negotiations that Government will lift these restrictions when, as agreed under Credit 110-KO, freight rates are revised.

## 3. THE KOREAN NATIONAL RAILROAD

### A. Organization and Management

3.01 Until 1963, KNR was an integral part of the Ministry of Transportation; it had no separate legal status or independent management. A requirement under Credit 25-KO in 1962 was that the Government should establish and maintain the Railroad as a separate entity with an appropriate organization and powers. In 1963, under the Government Organization Law, KNR was established with an independent manager and its own budget and accounting. The revised organization of the Railroad was an improvement, but there was still an excessive degree of dependence on and control by Government in financial, budgeting and staff matters. Under Credit 110-KO in 1967 the Government undertook to find suitable organizational solutions. Specifically there is need for more autonomy in financial matters, while on the staff side, KNR is still part of Government with senior appointments being controlled by the President of the Republic and with scales of remuneration tied to Government, not generally competitive with industry. During negotiations, agreement was reached on measures to increase KNR's autonomy in financial matters (para. 6.25). On the staff side, KNR and Government maintained that no major problems exist and that considerable constitutional difficulties would be encountered in transferring KNR's staff from the present Government civil service rules and regulations to the direct control of KNR. It was agreed that the present and foreseeable situation does not warrant making changes which would involve such difficulties for the Government and KNR.

3.02 Management suffers from a shortage of senior qualified engineering, economic and accounting staff. This fact, together with the size and complexity of KNR's development program, led to a requirement under Credit 110-KO that KNR engage consultants to study (i) the whole complex problem

of the reception, storage, manufacture (into briquets) and distribution of coal in the Seoul area; and (ii) statistics, traffic costing, freight car design and maintenance, marshalling yards and uneconomic lines. Study (i) has been satisfactorily completed by SOFRERAIL (France), see paragraph 3.35. There was some delay in agreeing to the terms of reference for the other studies but a contract was finalized in August 1969 with Touche, Ross & Co. (Canada), assisted by staff of Canadian National Railways. In addition it was agreed during the negotiations for the proposed loan/credit that KNR would prepare a staff training program.

B. Staff

3.03 The employment of qualified management staff has been adversely affected by the substantially higher salaries paid by private enterprise. The wage level of lower grade staff is also low. To correct this, KNR embarked, at Government direction and in common with other Government enterprises, on a policy of improving all wages and salaries by granting annual increases of 30% (about 20% in real terms) during the 1966-1968 period. The gap between KNR and private sector remunerations is to be narrowed still further by the continuation of this policy in the years 1969-1971. Even with the doubling of wages and salaries between 1965 and 1968, total staff costs in 1968 were only 34% of operating expenses, which is low in relation to other railways.

3.04 The number of permanent employees at the end of 1968 was 35,192, an increase of 8,900 or 34% since 1961. In the same period, traffic units (ton-km + pass-km) increased by 129% and productivity per employee rose by 66% from 298,000 to 496,000 traffic units, which is good compared with most other railways (for instance, Chile 184,000; South Africa 275,000; Japan 519,000). There is scope for further improvement of KNR through modernization and increasing mechanization, both of which are in progress and should be aided by future implementation of the consultants' recommendations and by the investments under the proposed loan/credit.

3.05 As a result of transfer to permanent status, the number of temporary employees decreased from 5,400 in 1966 to 3,800 in 1968. Of these some 3,300 are used in the workshops, largely for the construction of new passenger and freight cars and the rebuilding of old cars.

3.06 In general, relations with labor are satisfactory and staff displays excellent discipline and industriousness.

C. Railroad Property

(i) Railway Lines

3.07 At the end of 1968, KNR operated 3,108 route-km of standard gauge (1.435 m) and 126 km of narrow gauge (0.915 m) lines (Map). The condition of track is satisfactory but, although 30% of the track length is laid in 50-kg/m rails, with the growth of traffic and use of heavier diesel locomotives, further 50-kg/m rail relaying is necessary and planned.

KNR proposed relaying 1,475 km during the plan period, but in the Bank's opinion a program of about 1,000 km would be more appropriate to KNR's requirements and capacity. Centralized traffic control (CTC) was installed in October 1968 on the single track line of heaviest traffic running east from Seoul; increasing traffic on this line is still creating capacity problems which are the subject of later comments (paras. 3.11-3.14). KNR also plans further installation of CTC in the Seoul area, to be financed from German bilateral aid. Line capacity is being expanded by extending crossing loops and handling facilities at major stations.

(ii) Motive Power and Rolling Stock

3.08 KNR's motive power and rolling stock position at the end of 1968 is given in Table 3. The fleet consisted of 367 locomotives (115 steam, 252 diesel); 161 diesel rail cars; 1,336 passenger coaches and 13,239 freight cars.

3.09 The 115 steam locomotives (of which 75 are in active duty) are to be retained until they can be replaced by modern power, the final phase-out taking place in 1973. In April/May 1969, KNR received 30 additional diesel locomotives (10 main line and 20 shunters) financed by the Export-Import Bank (USA).

3.10 Consultants will be appointed to study the problem of diesel locomotive and rail car maintenance (in conjunction with the related workshop problem discussed later in paragraph 3.20). During negotiations agreement was reached on the terms of reference of such a study (Annex 2) and because of its urgency, finalization of the consultants' contract is made a condition of effectiveness of the proposed loan/credit.

3.11 Development of the fast growing cement industry in the north-eastern part of Korea, where the major anthracite coal mines are also located, creates heavy traffic between this area and Seoul. Situated in mountainous country with no highway connections at present, this area is linked to Seoul by some 350 km of single track railway lines. In 1968, these lines carried 11.5 million tons or 40% of KNR's freight traffic, and by 1981 this tonnage is expected to double. To meet such an increase in traffic will require (a) double tracking or (b) improved operations giving substantial increased line capacity.

3.12 Double tracking, because of the difficulty of the terrain, would be very expensive (present estimates are about US$90 million) and would take a long time to complete. The possibility of improved operations has been examined (Annex 3) and the most practical and economic solution is considered to be electrification of the existing single lines.

3.13 The entire electrification project, including ground facilities, motive power, modification of signals, communications, and the construction of a 13-km link line between Go Han and Hwang Ji stations (shortening the hauling distance between East-West by about 50 km) is estimated to cost

about US$63 million equivalent. The work will require about three years for completion as against KNR's original estimate of two years. KNR has negotiated a contract of about US$57 million equivalent with a consortium of European manufacturers (Belgium, France, Germany, Switzerland) for the financing and execution of the electrification scheme (excluding construction of the 13-km link being financed by KNR). The cost estimates are reasonable, and the terms and conditions obtained are satisfactory. The contract is awaiting ratification by the Governments involved.

3.14 On the basis of 1973 traffic, electrification, as compared with theoretical diesel traction, will result in a yearly operating saving of about US$1 million equivalent. According to present traffic forecasts, electrification would fully meet traffic demands for at least the next 15 years.

3.15 About 800 of the 1,336 passenger coaches are under 10 years old. These, together with about 240 modern coaches acquired in 1968, KNR's annual production of about 100 new cars and the rebuilding of old cars in its workshops, should cover requirements over the plan period.

3.16 The average capacity of freight cars is about 35 tons and is expected to increase as more new higher capacity units, 50-ton (or higher) cars, are placed in service. Some 30% of all freight cars are over 25 years old and have been used extensively. Productivity is satisfactory, but the physical shortage of freight cars is at present one of the main bottlenecks in Korean transportation. As discussed in Annex 4 (Item IV), to carry the forecast traffic would require the acquisition of 4,250 new cars during 1969-1971. KNR's proposals were for about 2,250 cars and, as agreed during negotiations, provision for an additional 2,000 cars has been included in the revised plan.

(iii) Telecommunications

3.17 Much of KNR's existing telecommunications network has reached the end of its expected life and is in extremely poor condition; operations are being hampered by failures and breakdowns. A program was submitted by KNR for modernization and development of the communications network. Except for some items of low priority which have been deleted at the Bank's suggestion, it forms a provisional basis for Bank financing. This program which, together with its engineering and traffic justifications, is set out in Annex 5, would take care of the priority requirements. In order to finalize the proposals, carry out the detailed engineering design and also rationalize plans for expansion of KNR's telecommunications network, it was agreed during negotiations that KNR would obtain expert advice through the employment of consultants whose terms of reference (Annex 6) were agreed upon.

(iv) Marshalling Yards, Workshops and Other Property

3.18 Marshalling yard facilities, now under study by the Canadian consultants, are generally inadequate in relation to rapidly expanding traffic and the need to increase consolidated train load operations. Major enlargements of general purpose yards are planned at Je Cheon, Pu San, and in the Seoul area. Whether these investments are appropriately responsive to the needs of the system has yet to be established. Agreement was reached during negotiations that implementation of KNR's plans would not commence until the consultants' studies of yards, now under way, have been completed in about mid-1970, and their recommendations agreed with the Association.

3.19 KNR presently has four main workshops: Yeon Deung Po (Seoul) for steam traction; Yong San (Seoul) for diesel rail cars, passenger and freight car maintenance; In Cheon, for constructing and rebuilding passenger coaches and freight cars; and Pu San, for heavy maintenance of diesel locomotives and repairs of freight cars. Replacement of workshop plant and equipment is necessary and planned. Yeong Deung Po workshop will be closed when steam traction is phased out by about 1973; the area is then planned for freight handling facilities. Electric locomotives, to be delivered in 1973 and after, will be maintained at Je Cheon, which is the best location and where existing facilities can be adapted for this purpose.

3.20 KNR also proposes to build a new workshop at Dae Jeon. The Korean Transport Survey of 1966 questioned the justification of this investment and the Bank shared these doubts. It was agreed during negotiations that (a) consultants would review the present position (draft terms of reference in Annex 2), and (b) construction of the Dae Jeon workshop would be postponed until the consultants' recommendations are available and have been commented upon by the Government, KNR and the Bank. Because of the urgency of the proposed study, finalization of the consultants' contract is made a condition of effectiveness of the proposed loan/credit.

3.21 KNR's plans for Dae Jeon workshop included the manufacture of motive power and rolling stock. While KNR is capable of repairing motive power and rolling stock and of semi-manufacturing the latter, it is doubtful that it can economically undertake full manufacture of motive power and rolling stock. This is particularly so for motive power, which requires highly specialized technology. The market is also comparatively small and highly competitive. It was agreed during negotiations that KNR would not be caused, or permitted, to engage in the manufacture of motive power.

3.22 Many of KNR's buildings (offices, stations, sheds) are old and too small for growing traffic requirements. At 37 stations, the buildings will be improved for passenger use. Much needed new railway headquarters

will be erected in front of the Seoul passenger station with underground access to the station; this will take the form of a 21-story building, 17 floors of which will be rented.

D. Traffic and Operations

(i) Freight Traffic

3.23 Freight traffic statistics for the period 1964 to 1968 are shown in Table 4. In this period, the yearly growth was about 9% in tonnage and 11% in ton-km. This was almost entirely due to commercial traffic 1/ which grew 10% in tonnage and 12% in ton-km. Commercial freight now accounts for 89% of all ton-km, as against 51% in 1955. The principal commodity carried is coal, which increased from 8.2 million tons in 1964 to a peak of 11.0 million tons in 1967 and declined to 9.6 million tons in 1968 (because of mild weather in the 1967/68 winter and increasing substitution for coal in household consumption). Cement traffic has increased at a rate in excess of 25% annually, to reach 3.1 million tons in 1968. High increases were registered in the haul of iron ore, oil, fertilizer and grains. In 1968 the composition of bulk goods in KNR's commercial traffic was as follows:

| | % of tonnage | % ton-km |
|---|---|---|
| Coal | 31% | 34% |
| Cement | 13% | 14% |
| Oil, grain, fertilizer, ore and timber | 28% | 29% |
| | 72% | 77% |

3.24 In 1969 the average length of haul of commercial traffic was 240 km and has increased by 2.6% during the last five years. This is largely a result of a process of import substitution: goods previously hauled from the ports to the consumption area (i.e., In Cheon-Seoul) are now being hauled from more distant plants in Korea (i.e., Ulsan-Seoul). The growth in net ton-km in 1967 and 1968 was 13.4% and 11.1%, respectively, which is in line with the average rate of 11% per annum used for the appraisal of the second railway project for the 1967-1971 period. However, in 1968, the actual traffic figure was 4% below the forecast, reflecting the inadequacy of KNR transportation capacity to meet the demand.

3.25 In 1972 freight traffic is expected to reach a total of 43.7 million tons and 11.4 billion ton-km, an average yearly increase of 11% in tonnage and 13% in ton-km. The average length of haul should increase from 244 km in 1970 to 268 km in 1972, mainly because of a continuation of the process of import substitution. The largest volume of railway

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1/ as distinct from military and railway service freight.

traffic is coal which, in 1972, should reach a volume of 12.2 million tons and would account for 36% of the total. Production and haulage of coal are expected to level off at the 1972 figures. Despite the process of substitution by some coal users in urban houses and industry, a reverse process is taking place at farmers' homes to replace firewood by coal. This is strongly supported by the Government to prevent deforestation. Coal use is also encouraged because of the shortage of foreign exchange to pay for oil imports. Cement transport is expected to have a dramatic increase during the period from 4.4 million tons in 1969 to 9.1 million tons in 1972, accounting that year for 21% of total freight traffic. The cement industry located in the northeastern region is expanding its capacity to cope with the increasing demand of the building and highway construction industries. Haulage of petroleum products will increase as two new refineries begin operations during the period. Grain traffic will increase as local production substitutes for imports.

(ii) Passenger Traffic

3.26 Table 5 shows that during the 1964-1968 period, the annual increase in passengers was 5% and in pass-km 8%, with the average distance per journey increasing from 62 to 70 km. A 35% fare increase in January 1965 produced a decline of 6% of total pass-km in that year. In 1966 and 1967 traffic in pass-km increased rapidly by 25% and 10%, respectively. Fares were again increased by 50% late in 1967 and in 1968 the number of passengers remained at the 1967 level; however, total pass-km rose by 10% because of the increased average distance of journey, and was somewhat higher than the forecast used for the appraisal of Credit 110-KO.

3.27 Commuter traffic is concentrated on the Seoul-In Cheon line. In 1968, commuter traffic represented 26% of the total passengers carried and 8% of the pass-km, long distance traffic 73% and 88%, respectively, and military personnel the balance of 1% and 4%, respectively.

3.28 Passenger traffic forecasts are given in Table 5 and are expected to reach, in 1972, a total of 206 million passengers and 14.4 billion pass-km, with a growth rate of 8% per annum. Commuter traffic is expected to grow at 7% per annum and long distance traffic at 8.5% per annum. This growth appears reasonable until the end of the period, given the expected growth of income and population, and the inadequacy of the highway network.

3.29 In the long run KNR, especially in the field of passenger services, can expect to meet increasing competition from road transport as the new expressways and improved roads are completed. However, provided KNR can offer efficient service, it should be able to maintain its position in freight traffic since over 75% of the freight carried consists of bulky low value commodities which are not suited to road transport.

(iii) Operations

3.30 Table 6 gives a summary of operating statistics from 1963 to 1968. It shows that operating efficiency is satisfactory: traffic units

per locomotive have risen by 47% during this period, traffic units per employee by 19%, and pass-km per passenger car have improved by 10%. Steam traction is mostly confined to shunting services and only about 1% of the train-km are steam operated (against 36% in 1963); steam has, however, to be retained until completion of the electrification program on selected lines (i.e. about 1973); the release of diesel locomotives coming from these electrified lines will enable the phaseout of steam traction to be completed.

3.31 Availability of diesel locomotives has been maintained at about 95%, but is likely to fall below 90% when KNR begins to carry out regular maintenance required by the aging of the fleet; the daily output of 411 km per engine available is satisfactory. Availability of diesel rail cars is only 82% and the daily performance, 342 km, shows a decrease of 11% since 1966; this kind of equipment is not suited to the rugged Korean conditions and KNR does not plan further acquisition of rail cars.

3.32 The average daily run per passenger coach available is 280 km, which is satisfactory, but the availability of passenger stock, 87% in 1968, should be improved. Passenger cars have an average occupancy of 75%, which is high.

3.33 Freight cars carry close to their effective capacity, 32 tons, against an average capacity of 35 tons. Productivity of freight cars in 1968, at 519,000 ton-km per car in fleet, has increased by 25% since 1963 and is very high compared to that of other railways (Germany: 164,000; France: 210,000; Argentina: 265,000; Japan: 408,000). From a statistical point of view this is an excellent performance but it is also a sign that demand exceeds supply and that customer service is therefore likely to be poor.

3.34 These figures of use and performance indicate that increases in traffic must entail further investment to expand capacity. However, there is scope for better utilization of some existing assets. For example, with the provision of more adequate storage, the turn-around time of oil tank cars has recently been improved from 6.5 to 3.4 days. Improved maintenance of rolling stock, installation of adequate loading and unloading facilities, and proper handling of coal traffic, together with improved telecommunications, should allow for a progressive reduction in car turn-around time which now averages 4.6 days.

3.35 The coal problem, which is reviewed in Annex 7, has been studied by consultants appointed under Credit 110-KO but no action has been taken on their recommendations. Since coal traffic and distribution is the responsibility of a number of parties (KNR, coal interests, briquet manufacturers, City of Seoul, Government Agencies), coordinated action led by the Government is necessary, and a coordinating body should be established for this purpose. It was agreed during negotiations that (a) before the end of June 1970, the Government will prepare a program, satisfactory to

the Bank, for the implementation of the consultant's recommendations; (b) the Economic Planning Board (EPB) will be the responsible agency for the coordination of the implementation program; and (c) the recommendations will be executed and implemented by December 31, 1972.

## 4. THE PLAN AND THE PROJECT

### A. The Plan

4.01 KNR's original Second Five-Year Plan 1967-1971, as agreed and appraised under Credit 110-KO, amounted to W 57.4 billion (US$217 million equivalent). The additional works carried over from the 1962-1966 program brought total investment over the plan period to an estimated W 63.6 billion (US$240 million equivalent) with a foreign exchange component of US$91 million equivalent.

4.02 In 1968, the Government revised its Second Five-Year Development Plan, 1967-1971, and to meet the needs brought about by the rapid pace of development, KNR also revised its plan of investment for this period. The revised plan has been appraised by the Bank and, with certain revisions as a result of this appraisal, is now estimated to involve expenditure of about W 89 billion (about US$308 million equivalent), with an estimated foreign exchange component of US$147 million (Tables 7 and 8).

4.03 The main amendments to the original 1967-1971 Plan (Annex 4) and the scope of the revised 1967-1971 Plan, a summary of which is given below (see Annex 4 for a description of the main items), were agreed during negotiations. Assurances were also obtained that KNR would not undertake major investments outside the agreed plan without the prior approval of the Bank.

1967-1971 Investment Plan Summary (Revised)

| | W billion | | | US$ million | | | % of Total |
|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | Expenditure |
| 1. Construction of New Lines | 7.1 | 0.1 | 7.2 | 26.0 | 0.6 | 26.6 | 9 |
| 2. Increase in Station and Line Capacity | 18.9 | 4.1 | 23.0 | 65.4 | 13.6 | 79.0 | 26 |
| 3. Way and Structure Renewals and Improvements | 4.8 | 4.1 | 8.9 | 16.9 | 13.6 | 30.5 | 10 |
| 4. Motive Power and Rolling Stock | 10.1 | 31.4 | 40.2 | 30.5 | 109.9 | 140.4 | 46 |
| 5. Rolling Stock Equipment and Construction | 1.6 | 0.5 | 2.1 | 5.4 | 1.8 | 7.2 | 2 |
| 6. Miscellaneous | 2.0 | 1.2 | 3.2 | 6.7 | 4.0 | 10.7 | 3 |
| 7. Total | 43.2 | 41.4 | 84.6 | 151.0 | 143.4 | 294.4 | 96 |
| 8. Contingencies | 3.0 | 1.1 | 4.1 | 10.0 | 3.3 | 13.3 | 4 |
| 9. Grand Total | 46.2 | 42.5 | 88.7 | 161.0 | 146.7 | 307.7 | 100 |

## B. The Project

4.04 The Project consists of the last two years of KNR's revised Development Plan 1967-1971. The goods and equipment will be contracted during the period, but some payments will carry over to 1972 (para. 4.12). The total cost of the Project is estimated at W 47.5 billion (US$155.8 million equivalent) with a foreign exchange component of about US$83.7 million, of which US$55 million would be provided by the proposed loan/credit. A breakdown of the Project is given below with brief details:

| | W billion | | | US$ million | | | % of Total |
|---|---|---|---|---|---|---|---|
| | Local | Foreign | Total | Local | Foreign | Total | Expenditure |
| 1. Construction of New Lines | 1.3 | - | 1.3 | 4.1 | - | 4.1 | 3 |
| 2. Increase in Station and Line Capacity | 9.8 | 3.5 | 13.3 | 32.1 | 11.3 | 43.4 | 28 |
| 3. Way and Structure Renewals and Improvements | 2.0 | 2.9 | 4.9 | 6.5 | 9.7 | 16.2 | 10 |
| 4. Motive Power and Rolling Stock | 3.9 | 17.1 | 21.0 | 12.9 | 55.9 | 68.8 | 44 |
| 5. Rolling Stock Equipment and Construction | 0.5 | - | 0.5 | 1.8 | - | 1.8 | 1 |
| 6. Miscellaneous | 1.5 | 1.0 | 2.5 | 4.7 | 3.5 | 8.2 | 5 |
| 7. Contingencies | 3.0 | 1.0 | 4.0 | 10.0 | 3.3 | 13.3 | 9 |
| | 22.0 | 25.5 | 47.5 | 72.1 | 83.7 | 155.8 | 100 |

4.05 "Motive Power and Rolling Stock" covers 50 diesel locomotives, 240 passenger cars (locally built), 48 heater cars, 3,740 freight cars including specialized cars (2,740 to be procured, 1,000 to be built by KNR) and 1,680 containers. The diesel locomotives are required to help phase out steam traction and to move the expected traffic. The passenger cars will be needed to carry the expected growing traffic, while the heater cars are required for passenger trains hauled by diesel locomotives. The freight cars and the specialized cars will give much needed additional capacity and should improve operating efficiency. During negotiations it was agreed that KNR would engage consultants to assist in evaluating the bids for diesel locomotives and for track maintenance equipment.

4.06 "Increase in Station and Line Capacity," which comprises the commencement of ground facilities for electrification of 350 km of single track line, signalling and track extensions including installation of CTC in the Seoul area, improvements to marshalling yards and freight handling facilities, is required to increase KNR's ability to meet the forecast traffic demand.

4.07 "Way and Structure Renewals and Improvements" covers track renewals and replacement of 37 kg/m rail with 50 kg/m rail, and procurement of mechanized track maintenance equipment. Track renewals and the re-laying of heavier rail, apart from the need for track replacement on a regular

cycle, enable the railway to employ higher axle loads and to carry greater densities of traffic at higher speeds. Mechanical track maintenance equipment will improve the quality of work.

4.08 "Miscellaneous" consists largely of improvements to telecommunications necessitated by the age and poor condition of the equipment, as explained in Annex 5 and paragraph 3.17.

4.09 "Contingencies:" KNR's cost estimates are based on 1969 prices, but with annual increases in wage rates and other local costs an allowance of about 15% has been made for price contingencies on local expenditure; in addition, with wages and other costs rising in the industrialized countries, together with some uncertainty regarding the foreign exchange costs of certain items, an allowance of about 7-1/2% has been made for contingencies on foreign costs of items other than those to be financed by the proposed loan/credit. In this case, the cost margins are considered more ample, and a contingency allowance of about 3% is sufficient.

C. Financing of the Project

4.10 The resources available to finance the Project coming from KNR's generation of funds and from local and foreign financing secured or promised are detailed in paragraphs 6.19 and 6.20 and in Table 9.

4.11 The Project items to be financed by the proposed Bank loan and IDA credit are listed in paragraph 4.12 and described in Annex 8.

D. Execution of the Project, Disbursement and Procurement

4.12 KNR is competent, with the help of consultants, to carry out the Project. Cost estimates, based on 1969 figures, but with the addition of a contingency allowance as explained in paragraph 4.09, are reasonable. Disbursement will be made on the basis of c.i.f. costs of imported equipment, or ex-factory price of goods procured in Korea, and of the foreign cost of consulting services and training. Because of inevitable delays in preparation of designs for telecommunication equipment and in delivery of diesel locomotives, disbursements will spread over into 1972 as shown below:

| | Total | Annual Expenditure 1970 | 1971 | 1972 |
|---|---|---|---|---|
| | | | (US$ million) | |
| 50 diesel locomotives and spares | 19.5 | 2.0 | 7.5 | 10.0 |
| 2,740 freight cars | 28.4 | 2.0 | 14.5 | 11.9 |
| Track maintenance equipment | 2.4 | .2 | 1.6 | .6 |
| Telecommunication equipment | 2.6 | - | .3 | 2.3 |
| Consultants and Training | .5 | .4 | .1 | |
| | 53.4 | 4.6 | 24.0 | 24.8 |
| Contingencies (3%) | 1.6 | .1 | .7 | .8 |
| | 55.0 | 4.7 | 24.7 | 25.6 |
| In billion Won equivalent | 16.76 | 1.43 | 7.53 | 7.8 |
| % | 100 | 8 | 45 | 47 |

4.13 The proposed loan/credit of US$55 million equivalent would be 35% of the total cost of the Project which is estimated at about US$156 million equivalent. All items to be financed by the loan/credit will be procured through international competitive bidding in accordance with the procedures of the Bank. It is expected that local Korean firms will participate in bidding for the construction of the 2,740 freight cars. If they are successful it would imply some local expenditure financing from the proposed loan/credit; details on this are given in paragraph 6.22. For the purposes of bid evaluation local bidders would be accorded a nominal preference margin of 15% or the level of customs duties applicable to such goods when imported, whichever is lower. Withdrawals from the loan would be made after the whole of the credit has been withdrawn or committed. If any savings in foreign expenditure result from favorable prices in competitive bidding the corresponding savings in the loan account would be used to finance the foreign exchange cost of additional but similar project items subject to review and agreement with the Bank.

## 5. ECONOMIC EVALUATION

### A. Introduction

5.01 Investments contained in KNR's Development Plan, 1967-1971, are primarily designed to increase capacity to meet rapidly growing traffic

demands. Since most of KNR's traffic consists of commodities such as coal, ore, oil, fertilizer and cement, which are clearly rail-oriented and suited to the use of large freight cars and, often, consolidated trainloads, there is considerable scope for the purchase of more powerful locomotives, larger cars and heavier track. Such investments would help to modernize equipment and reduce operating costs.

5.02 The Investment Plan as presently amended is designed to meet traffic demand in 1970-1971 which is expected to be, in 1971, about 10% greater than that forecast for Credit 110-KO. Investment during the period in such items as electrification, rail renewal, signalling and telecommunications would also help KNR to cope with expected growing traffic after 1971. At present, a shortage of transport capacity is forcing industrial plants in the northeast and Ulsan areas to increase inventories and reduce production while the demand of consumers and other industries remains unsatisfied. For the movement of coal, cement, grains, oil, iron ore and many other commodities, the railway is the most economic carrier in Korea and provides the only network connecting all parts of the country with the large commercial and industrial centers of Seoul and Pu San as well as with the ports handling foreign trade.

5.03 If the total railway investment plan were not carried out, large tonnages of coal, cement, iron ore, oil products, grain and fertilizer would have to be diverted at very high cost to coastal shipping transport. Otherwise the Korean economy would not be able to reach targets of production and income. The higher costs of coastal shipping are a result of the longer distances involved to connect the same points by sea as compared with land transport. Between Mug Ho port in the northeast and Seoul, for instance, there are 950 km by sea to In Cheon and an additional land haul of 32 km to Seoul. The direct rail connection is only 310 km. Comparisons of total transport costs between rail and coastal shipping are given in Annex 9, paragraph 1. The revised railway investment plan is therefore clearly economically justified. The detailed rates of return have been calculated only for those items which are to be financed by the proposed loan/credit.

B. Economic Benefits

5.04 These items would increase KNR's capacity to meet traffic requirements and would help to improve efficiency and reduce the cost of various railway operations. New freight cars and diesel locomotives are needed to meet the present shortage of transport capacity to haul the anticipated growth in traffic volumes and to assist in the replacement of over-age equipment. New telecommunication equipment is required to replace obsolete and over-age installations which are presently unreliable and insufficient to satisfy KNR's needs. The track maintenance equipment to be provided under the project would help modernize present operations which are mostly manual, reducing costs and improving quality of works. All benefits are discussed in detail in Annex 9. The economic rates of return

on these items are estimated to be: freight cars, 26%; diesel locomotives, 16%; telecommunication equipment, 17%; and track maintenance equipment, 32% with an overall return of 23%.

5.05 Not included in the quantifiable benefits are savings in freight travel time, savings caused by reduced inventories of industries, reliability of communications and better quality of mechanized maintenance. All the benefits have been conservatively estimated and show the project to be economically well justified and of high economic priority.

## 6. FINANCES AND EARNINGS

### A. Tariffs

6.01 KNR, in common with all Government enterprises, must have its tariffs approved by the Government, after review by a rate making "Committee for Decisions on Utility and Public Enterprise Commodity Rates," headed by the Deputy Prime Minister, assisted by four ministers and ten other qualified persons.

6.02 Details of the freight rate and passenger fare structure are given in Annex 10. Tariffs are generally low, but as agreed under Credits 25-KO and 110-KO, increases were granted in 1964, 1965 and 1967 as follows:

| | Freight Rates | Passenger Fares |
|---|---|---|
| January 1, 1964 | 15% | 15% |
| January 1, 1965 | 15% | 35% |
| October 1, 1967 | 30% | 50% |

These increases have barely matched cost increases, particularly in the case of freight rates which have been held at low levels as a Government policy. The average revenue per ton-km of W 1.41 in 1968 is equivalent to only US0.83 cents per ton-mile, which is low by any international standard.

6.03 As required under Credit 110-KO, in addition to the increases effective October 1, 1967, tariffs were to be revised as necessary to bring rates and fares into relationship with the costs of the services provided, taking into account the recommendations of consultants now engaged to study KNR's costs and tariff structure. The consultants, mentioned in paragraph 3.02, are expected to complete their work and present their report by April 1970.

6.04 As of May 20, 1969, KNR expanded the existing three freight rate categories to five, increasing the rates on certain commodities as shown in Annex 10. The general effect is to raise the average revenue per ton-km from W 1.42 to W 1.63. In a full year total freight revenue would be increased by about 15% or W 1.3 billion based on 1968 traffic.

6.05 KNR requested Government permission for an across-the-board increase on all tariffs, to be effective January 1, 1970, in order to compensate for rising costs affected by wage awards and other inflationary factors. The Government agreed only to a 35% increase in passenger fares, effective on December 27, 1969. This increase, which has been taken into account in forecasting the 1970 and 1971 revenues, would be sufficient to produce a rate of return of about 6.4% in 1970, but further selective adjustments in tariffs will be necessary in 1971 in order to offset rising costs, to provide adequate working capital and to reach a rate of return of no less than 7%. Such tariff increases should be related to fully distributed costs but should also take into account conditions of competition on alternative modes of transport. Agreement on this was obtained during negotiations.

B. Operating Results

(i) Actual

6.06 The income accounts for the years 1964-1968 are given in Table 10. Except for 1966, when rising costs were not matched by tariff increases, annual net revenue has shown a steady rise, together with an improved operating ratio. Summary figures are given below.

| | W Billion | | | | |
|---|---|---|---|---|---|
| | 1964 | 1965 | 1966 | 1967 | 1968 |
| Operating Revenue | 10.4 | 13.1 | 15.7 | 19.9 | 27.4 |
| Working Expenses | 7.7 | 9.6 | 12.7 | 14.6 | 17.5 |
| Depreciation | 2.1 | 2.0 | 2.2 | 2.5 | 3.7 |
| Operating Expenses | 9.8 | 11.6 | 14.9 | 17.1 | 21.2 |
| Net Operating Revenue | 0.6 | 1.5 | 0.8 | 2.8 | 6.2 |
| Other Income (loss) | 0.6 | 0.2 | 0.3 | ( 0.1 ) | 0.9 |
| Interest Charges | 0.4 | 0.3 | 0.4 | 0.9 | 1.3 |
| Net Income | 0.8 | 1.4 | 0.7 | 1.8 | 5.8 |
| Operating ratio % | 94 | 89 | 95 | 86 | 77 |

6.07 Interest and debt coverage ratios, varying between 2.9 and 5.7 and 4.1 and 7.1, respectively, were adequate over the period. Depreciation was about 13% of gross operating revenue and 3% of average gross depreciable fixed assets, which is reasonable.

6.08 The rate of return on average net fixed assets in use, varying between 1.5% and 2.5% during 1965, 1966 and 1967, was inadequate for KNR to generate sufficient funds for investment, and the Government and KNR agreed, under Credit 110-KO, to increase tariffs sufficiently to improve

the return to not less than 5% for the years 1969 and 1970, rising to not less than 6% thereafter. The tariff increases of October 1, 1967 resulted in the rate of return improving to 4.4% in 1968.

6.09 KNR is not required to make a contribution from its net revenues to Government, but is expected to finance investment, replacements and debt service from its own earnings, assisted by long-term foreign loans or short-term local finance and, where necessary, by capital grants from Government.

(ii) Future

6.10 The operating income and expenditure forecast 1969-1971 is also given in Table 10. It reflects tariff increases discussed in paragraphs 6.04 and 6.05. It also takes into account the cost of moving the growing traffic expected over the period, and the effect of substantial rises in wages and salaries expected in each year, and of other cost increases; on the other hand, allowance has been made for economies which should result from increased dieselization, improved operations and other measures to increase efficiency, expected to materialize during this period.

6.11 Gross operating revenue is expected to rise from W 27.4 billion in 1968 to W 47.6 billion in 1971, while operating expenses, including depreciation based on the replacement value of all depreciable fixed assets, would increase from W 21.2 billion in 1968 to W 39.5 billion in 1971.

6.12 The following is a summary of operating income and expenditure forecasts during the period 1969-1971. Firm figures for 1969 are not yet available, but the forecast has been revised to allow for the latest information available.

| | Gross Operating Revenue | Working Expenses | Cash Surplus | Depreciation | Net Operating Revenue | Operating Ratio |
|---|---|---|---|---|---|---|
| | | (in W Billion) | | | | % |
| 1969 | 31.7 | 21.4 | 10.3 | 4.1 | 6.2 | 80 |
| 1970 | 42.9 | 27.2 | 15.7 | 4.3 | 11.4 | 73 |
| 1971 | 47.6 | 34.5 | 13.1 | 5.0 | 8.1 | 83 |

6.13 The operating ratio, which was 77 in 1968, is expected to improve to 73 in 1970, but to rise to 83 in 1971 at the end of the Project period, unless tariffs are increased. Times interest ratios, between 3.6 and 6.2, and debt coverage ratios, between 2.6 and 3.6, assessed in accordance with assumptions explained in paragraph 6.23, are both satisfactory.

6.14 The rate of return on average net fixed assets in use during 1969 (3.7%) did not reach the level of 5% agreed under credit 110-KO but should improve substantially to 6.4% in 1970 following a 35% increase in passenger fares made in late 1969. As shown in Table 10, given forecast

increases in wages and other costs, the return on net fixed assets will decline to 3.4% in 1971, unless KNR takes action to reduce costs and/or make selective tariff increases (with an overall incidence of the order of 15%). It was agreed during negotiations that to enable KNR to generate sufficient funds to maintain adequate working capital and to finance a material part of its capital expenditures, it will take the necessary steps to earn a rate of return of not less than 7% from 1971 on.

C. Financial Position

6.15 KNR's balance sheets as of December 31, 1966-1968 are shown in Table 11 and summarized below:

| | W Billion | | |
|---|---|---|---|
| | 1966 | 1967 | 1968 |
| Assets | | | |
| Net fixed assets (including work in progress) | 79.5 | 168.4 | 175.3 |
| Current assets | 4.3 | 4.9 | 12.5 |
| Other assets | 2.7 | 2.6 | 2.9 |
| Total Assets | 86.5 | 175.9 | 190.7 |
| Liabilities | | | |
| Current liabilities | 3.8 | 5.1 | 12.0 |
| Debt | 11.9 | 18.5 | 22.8 |
| Equity (including retained earnings and capital surplus) | 70.8 | 152.3 | 155.9 |
| Total Liabilities | 86.5 | 175.9 | 190.7 |

6.16 KNR's first physical inventory and valuation of fixed assets was completed in 1965, and the book value of the assets was adjusted in that year. The National Property Law requires the revaluation of National Controlled Real Property every five years. However, as required under a USAID loan (No. 489-H-037) of 1966, KNR carried out a further revaluation of its fixed assets as of December 31, 1966, which took into account the devaluation of the Won, in 1964, of almost 100%, and the considerable increase in the value of land owned by KNR. The revaluation increased the gross value of fixed assets by W 75.4 billion, and capital surplus was increased correspondingly.

6.17 The composition of the long-term debt as of December 31, 1968, is given in Table 12. The terms of the major loans range from 15 to 25 years, with an average interest rate of about 6%. The debt equity ratio at 13/87 is satisfactory.

6.18 The current ratio as of December 31, 1968, at about 1.0, was low, but should improve when tariffs are raised, improving KNR's generation of funds. The cash balance at about W 0.2 billion is unsatisfactory but usually it increases substantially in January when current accounts with Government are settled.

D. Cash Requirements

6.19 KNR's actual and estimated cash needs and sources of funds over the Plan period 1967-1971 and the Project period 1970-1971 are detailed in Table 9 and are summarized below.

| | Plan Period 1967-1971 (Won Billion) | Project Period 1970-1971 ( Won Billion) |
|---|---|---|
| Funds Required | | |
| Capital Investment: Local Funds | 46.2 | 22.0 |
| Foreign Exchange | 42.5 | 25.5 |
| Total Funds Required | 88.7 | 47.5 |
| Funds Available | | |
| From Borrowing: | | |
| Foreign - Existing loans | 11.4 | 0.3 |
| - Proposed loans | 20.2 | 20.2 |
| Local Loans: | | |
| Korean Exchange Bank (for foreign exchange) | 2.9 | - |
| Other (for foreign exchange) | 4.3 | 2.0 |
| Korean Reconstruction Bank (for local costs) | 1.7 | - |
| Sub-Total Borrowing | 40.5 | 22.5 |
| From KNR internally generated funds (net) | 42.5 | 20.4 |
| From Government, as capital grant | 5.7 | 4.6 |
| Total Funds Available | 88.7 | 47.5 |

6.20 For the period 1967-1971, net cash generated from operations, W 42.5 billion, together with capital grants from Government of W 5.7 billion and a loan of W 1.7 billion from the Korean Reconstruction Bank (W 49.9 billion in all) would finance all local currency costs of capital investment (W 46.2 billion) leaving a surplus of W 3.7 billion. Of the foreign exchange cost of investment (W 42.5 billion equivalent), W 11.4 billion would come from existing foreign loans, and W 16.8 billion from the proposed Bank loan and IDA credit of US$55 million equivalent, leaving W 14.3 billion to be secured. KNR is now concluding an agreement to obtain bilateral financing of about US$57 million, (about W 17.4 billion equivalent), on very reasonable terms, from a European Consortium for the electrification project, of which W 2.7 billion would be available in this period, and has also obtained bilateral financing of W 0.7 billion from Germany. In addition, KNR has obtained a loan of W 2.9 billion from the Korean Exchange Bank to help finance the purchase of passenger cars from Japan and short term loans from other sources, amounting to W 4.3 billion to help finance the purchase of rail and passenger cars. This leaves W 3.7 billion which, as agreed during negotiations, will be provided from Korean Foreign Exchange (KFX) resources, with KNR reimbursing the Government in local currency, from the local funds surplus referred to above. In view of the reasonable lending conditions that have to date been secured, borrowing of the magnitude indicated above is within the repayment capacity of KNR, and the financial plan described above is satisfactory.

6.21 Due to the delay in making freight tariff adjustments during 1969, and to the lower than expected tariff increases at the end of 1969, KNR's generation of funds over the years 1969-1971 is likely to be less than originally forecast. To cover this gap, the Government gave a capital grant of W 1.12 billion in 1969, and has promised further grants of W 2.82 billion in 1970 and W 1.8 billion in 1971, a total of W 5.7 billion which is included in the above financial plan.

6.22 Over the period 1970-71, and assuming foreign firms win all bids, the foreign exchange requirements of the project are estimated to be US$83.7 million equivalent, as follows:

| | | US$ Million (including contingencies) |
|---|---|---|
| (a) | Items being financed from bilateral and other sources | |
| (i) | Electrification | 8.9 |
| (ii) | Signalling equipment | 2.4 |
| (iii) | Track materials | 6.6 |
| (iv) | Consultants | 0.4 |
| (v) | Miscellaneous items | 0.4 |
| | Sub-Total | 18.7 |
| (b) | Other items: imported goods | |
| (i) | 50 Diesel locomotives and spares | 19.5 |
| (ii) | Track maintenance equipment | 2.4 |
| (iii) | Telecommunications equipment | 2.6 |
| (iv) | Consultants and training | 0.5 |
| (v) | 2,740 Freight cars | 30.0 |
| | Sub-Total | 55.0 |
| (c) | Other items: works carried out by KNR | |
| (vi) | Materials for bridge strengthening | 1.1 |
| (vii) | Parts for constructing 240 passenger cars | 3.2 |
| (viii) | Miscellaneous items for increasing line capacity | 0.5 |
| (ix) | 1,000 cars constructed by KNR (estimated direct and indirect foreign exchange element) | 5.2 |
| | Sub-Total | 10.0 |
| | Total (b) & (c) | 65.0 |
| | Grand Total | 83.7 |

Against this total, finance amounting to US$18.7 million has been and is being secured from bilateral, supplier, and other sources (US$8.9 million for electrification, US$2.4 million for CTC, US$6.6 million for rails and US$0.8 million for miscellaneous items under existing loans) leaving a foreign exchange gap of US$65.0 million, of which US$55 million will be covered by the proposed loan/credit. The remaining US$10.0 million will come from KFX funds. It is possible that under conditions of international competitive bidding some or all of the freight car orders will be secured by Korean firms. This is a new industry in Korea and the Bank has no previous experience of the capacity and competitiveness of the Korean firms

which are likely to bid. The local currency component of freight cars constructed in Korea is estimated at 50%, a total of about US$15 million equivalent for all 2,740 cars. Should local Korean firms win contracts for all the cars, US$15 million of the US$30 million loan/credit funds disbursed against these contracts would be available in effect to cover the US$10 million foreign exchange gap referred to above, allowing up to a maximum net contribution from the loan/credit of US$5 million toward the finance of local currency costs.

6.23 The cash flow (which does not allow for tariff increases in 1971 discussed in paragraph 6.05) has been prepared on the assumption that the borrowing to be secured would be on terms ranging from 15 to 25 years, including two to four years of grace, at about 7% interest. Likewise, it is assumed that the proposed Bank loan and IDA credit, to be made to the Government, will be extended to KNR on terms equal to those granted by the Bank (repayment over 25 years, including four years grace period and at 7% annual interest). Agreement was reached during negotiations that, should the need for financial assistance arise, the Government will make available to KNR all funds necessary to carry out the Project.

E. Forecast Balance Sheets

6.24 The actual and forecast balance sheet positions as of December 31, 1966-1971 are given in Table 11; those of 1968 and 1971 are summarized below:

| | Won Billion | |
|---|---|---|
| | 1968 | 1971 |
| Net Current Assets | (0.5) | 2.3 |
| Net Fixed Assets | 175.3 | 225.4 |
| Other Assets | 2.9 | 0.1 |
| Total | 178.7 | 227.8 |
| Equity | 155.9 | 183.4 |
| Debt | 22.8 | 44.4 |
| Total | 178.7 | 227.8 |

Although total debt is expected to increase by some 95% from W 22.8 billion in 1968 to W 44.4 billion in 1971, the debt/equity ratio should not exceed 20/80 which is favorable. The current ratio should rise to about 1.2 and the liquid ratio to about 0.7, neither of which are satisfactory, but the proposed tariff increases discussed in paragraph 6.05 should result in more working capital becoming available.

F. Budgets, Accounts and Audit

6.25 Operating and capital budgets are prepared in two forms, one as laid down for Government departments and the other based on the modern commercial accounting system installed by consultants financed under Credit 25-KO. Similarly, two sets of accounts are maintained because KNR has not been able to abandon the Governmental budgetary and accounting rules and regulations. This has a two-fold effect: (a) the control of the Government style of accounting by Ministry of Finance auditors is so detailed and strict that KNR's accounts staff cannot give sufficient care and attention to the commercial accounting system, leading to many criticisms in the report of the accountants who audited the 1966, 1967 and 1968 accounts; and (b) the Government form of budget is so rigid that the Director-General of KNR has no power to reallocate funds within the budget, such adjustments being authorized only to a limited extent by the Minister of EPB, or they have to wait approval of revised budgets by the National Assembly. During negotiations it was agreed that (a) commencing January 1, 1971, KNR will abandon the Governmental budgetary form of accounting and concentrate solely on the commercial form of accounts; and its budgets for 1971 onwards will be prepared in line with the commercial accounting system; (b) commencing 1973, KNR will install a performance budgeting system on the lines of that devised by consultants financed under Credit 25-KO; and (c) a limited delegation of power to make budget re-allocations will be granted to the Director-General of KNR by June 1, 1970.

## 7. RECOMMENDATIONS

7.01 During negotiations agreement was reached with the Government of the Republic of Korea and KNR on the following principal items:

(i) KNR's revised Second Five-Year Investment Plan and investment limitation beyond the Plan (para. 4.03);

(ii) diesel locomotive and rail car maintenance study (para. 3.10), Dae Jeon workshops study (para. 3.20), telecommunications study (para. 3.17) and consultant assistance in evaluating diesel locomotive and track maintenance equipment bids (para. 4.05);

(iii) revision of tariffs on cost basis and financial targets (para. 6.05);

(iv) measures to increase KNR's financial autonomy (para. 6.25);

(v) co-ordinated action on coal transport problem (para. 3.35) and re-organization of Government departments and agencies dealing with transportation.

7.02 Engagement of the consultants referred to in paragraphs 3.10 and 3.20 would be a condition of effectiveness of the proposed loan and credit.

7.03 The Project provides a suitable basis for a Bank loan of US$40 million equivalent and an IDA credit of US$15 million equivalent to the Republic of Korea. A term of 25 years including four years of grace is recommended for the loan, and the proceeds of the loan and credit should be made available by the Government of Korea to KNR on the same terms and conditions as those granted to the Government by the Bank with respect to the loan.

March 27, 1970
IBRD

TABLE 1

KOREA

THIRD RAILWAY PROJECT

Freight and Passenger Transport by Mode

A. Freight - Billion Ton/Km

| Year | Railroad | Highway | Coastal Shipping | Total |
|---|---|---|---|---|
| 1958 | 1.76 | 0.29 | 0.24 | 2.29 |
| 1959 | 2.15 | 0.32 | 0.18 | 2.65 |
| 1960 | 2.48 | 0.34 | 0.20 | 3.02 |
| 1961 | 2.70 | 0.30 | 0.24 | 3.24 |
| 1962 | 3.98 | 0.38 | 0.40 | 4.76 |
| 1963 | 4.36 | 0.43 | 0.30 | 5.09 |
| 1964 | 4.52 | 0.51 | 0.40 | 5.43 |
| 1965 | 5.04 | 0.50 | 0.40 | 5.94 |
| 1966 | 5.45 | 0.56 | 0.90 | 6.91 |
| 1967 | 6.18 | 0.65 | 1.20 | 8.03 |
| 1968 | 6.87 | 1.02 | n.a. | n.a. |

B. Passengers - Billion of Pass/Km

| Year | Railroad | Highway | Coastal Shipping | Aviation 1/ | Total |
|---|---|---|---|---|---|
| 1958 | 4.17 | 1.39 | 0.12 | 0.02 | 5.70 |
| 1959 | 4.54 | 1.79 | 0.14 | 0.02 | 6.49 |
| 1960 | 4.94 | 2.04 | 0.15 | 0.02 | 7.15 |
| 1961 | 5.37 | 2.24 | 0.14 | 0.02 | 7.77 |
| 1962 | 5.87 | 5.46 | 0.15 | 0.02 | 11.50 |
| 1963 | 6.68 | 6.57 | 0.17 | 0.03 | 13.45 |
| 1964 | 7.35 | 6.46 | 0.19 | 0.06 | 14.06 |
| 1965 | 6.92 | 7.98 | 0.18 | 0.07 | 15.15 |
| 1966 | 8.66 | 11.46 | 0.20 | 0.06 | 20.38 |
| 1967 | 9.56 | 11.70 | 0.22 | 0.06 | 21.54 |
| 1968 | 10.59 | 13.72 | 0.23 | n.a. | n.a. |

Source: EPB

1/ Domestic traffic only.

December 11, 1969

TABLE 2

KOREA

THIRD RAILWAY PROJECT

Number of Registered Motor Vehicles
(1964-1968)

| End of Period | 1964 | 1965 | 1966 | 1967 | 1968 | Average Annual Rate of Increase 1964-68 |
|---|---|---|---|---|---|---|
| Cars | 14,586 | 16,280 | 20,328 | 25,710 | 32,099 | 21% |
| Trucks | 14,951 | 16,015 | 19,432 | 22,955 | 28,728 | 18% |
| Buses | 7,600 | 8,422 | 9,384 | 10,746 | 12,152 | 12% |
| Special Vehicles | 678 | 794 | 1,016 | 1,286 | 1,223 | 16% |
| TOTAL | 37,815 | 41,511 | 50,160 | 60,697 | 74,202 | 18% |

Source: Ministry of Transportation

December 11, 1969

TABLE 3

KOREA

THIRD RAILWAY PROJECT

Composition of Motive Power and Rolling Stock as of December 31, 1966 and 1968 with 1971 Forecasts (excluding narrow gauge lines 1/)

| | Actual | | Forecast | 1971 over 1966 |
|---|---|---|---|---|
| | 1966 | 1968 | 1971 | + or - |
| 1. Motive Power | | | | |
| Steam locomotives | 242 | 115 | 115 | -127 |
| Diesel shunting locomotives | 13 | 14 | 34 | + 21 |
| Diesel mainline locomotives | 160 | 238 | 298 | +138 |
| Diesel railcar-motor units | 163 | 161 | 159 | - 4 |
| Total (excluding steam) | 336 | 413 | 491 | +155 |
| 2. Passenger Car Stock 2/ | | | | |
| Passenger and sleeping cars | 1,283 | 1,336 | 1,720 | +437 |
| Mail and baggage cars | 115 | 195 | 195 | + 80 |
| Railcar trailers | 163 | 163 | 163 | 0 |
| Total | 1,561 | 1,694 | 2,078 | +517 |
| Heater vans | 51 | 119 | 167 | +116 |
| 3. Freight Car Stock 3/ | | | | |
| Box cars | 4,113 | 4,482 | 7,300 | +3,187 |
| Gondolas | 3,403 | 3,966 | 3,600 | + 197 |
| Hopper cars | 1,471 | 1,666 | 2,300 | + 829 |
| Tank cars | 952 | 1,826 | 1,800 | + 848 |
| Other | 1,100 | 1,299 | 2,000 | + 900 |
| Total | 11,039 | 13,239 | 17,000 | +5,961 |

Notes: 1/ Narrow gauge lines: (126 km) are steam operated.

2/ Passenger cars:

| | 1966-1971 |
|---|---|
| Importation | 236 |
| Local construction | 410 |
| Scrapping | 129* |
| Total addition | 517 |

* instead of 300 cars scheduled to be scrapped

3/ Freight cars:

| | |
|---|---|
| Procurement (import and/or local) | 4585 |
| Local construction | 2640 |
| Scrapping | 1264* |
| Total additions | 5961 |

* by age, about 2000 cars should be phased out, but some must be rebuilt locally and retained in service

March 3, 1970

KOREA

THIRD RAILWAY PROJECT

KNR Freight Traffic

(1964-68: Actual; 1969-72: Forecast)

| COMMODITIES | 1964 | | | 1965 | | | 1966 | | | 1967 | | | 1968 | | | 1969 | | | 1970 | | | 1971 | | | 1972 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Tn | T km | AD | T | TK | AD | T | TK | AD | T | TK | AD | T | TK | AD | T | TK | AD | T | TK | AD | T | TK | AD | T | TK | AD |
| Grain | 1.2 | .289 | 240 | 1.1 | .295 | 268 | 1.2 | .318 | 265 | 1.3 | .338 | 260 | 1.6 | .406 | 254 | 1.5 | .400 | 267 | 1.7 | .440 | 259 | 1.9 | .489 | 257 | 2.0 | .544 | 272 |
| Fertilizer | 1.0 | .217 | 217 | 1.8 | .316 | 176 | 1.7 | .186 | 109 | 1.2 | .202 | 168 | 1.5 | .312 | 208 | 1.6 | .316 | 197 | 1.2 | .262 | 218 | 1.3 | .291 | 224 | 1.4 | .323 | 231 |
| Cement | 1.1 | .323 | 294 | 1.5 | .412 | 275 | 1.7 | .476 | 280 | 2.2 | .565 | 257 | 3.1 | .844 | 272 | 4.4 | 1.170 | 266 | 6.1 | 1.537 | 252 | 7.1 | 1.965 | 277 | 9.1 | 2.500 | 275 |
| Coal | 8.3 | 1.768 | 215 | 8.9 | 1.848 | 208 | 10.0 | 2.070 | 207 | 11.0 | 2.262 | 206 | 9.6 | 2.103 | 218 | 10.0 | 2.180 | 218 | 10.6 | 2.311 | 218 | 11.6 | 2.626 | 226 | 12.2 | 2.800 | 230 |
| Oil | .3 | .113 | 358 | .6 | .184 | 307 | .7 | .230 | 337 | 1.1 | .350 | 318 | 1.5 | .525 | 343 | 2.3 | .738 | 321 | 2.7 | .867 | 321 | 3.0 | .972 | 324 | 3.3 | 1.089 | 330 |
| Ore | .6 | .231 | 385 | 1.0 | .262 | 262 | 1.0 | .269 | 269 | 1.4 | .335 | 239 | 1.7 | .368 | 217 | 1.9 | .432 | 227 | 2.3 | .497 | 216 | 2.5 | .552 | 221 | 2.7 | .613 | 223 |
| Timber | .4 | .061 | 153 | .4 | .090 | 225 | .4 | .094 | 235 | .5 | .110 | 220 | .6 | .151 | 252 | .6 | .160 | 267 | .7 | .167 | 238 | .7 | .178 | 254 | .8 | .198 | 248 |
| Fruit and Vegetable | .4 | .102 | 255 | .4 | .121 | 303 | .4 | .126 | 315 | .4 | .114 | 285 | .3 | .110 | 367 | .4 | .120 | 300 | .4 | .130 | 325 | .5 | .160 | 320 | .5 | .160 | 320 |
| Other | 3.4 | .773 | 227 | 3.3 | .899 | 290 | 3.9 | .978 | 306 | 4.7 | 1.240 | 264 | 4.9 | 1.315 | 268 | 5.5 | 1.267 | 230 | 6.1 | 1.556 | 255 | 6.8 | 1.863 | 274 | 7.5 | 2.361 | 315 |
| 1. Sub Total Commercial | 16.8 | 3.907 | 233 | 18.8 | 4.427 | 235 | 20.1 | 4.755 | 237 | 23.8 | 5.496 | 231 | 24.8 | 6.124 | 270 | 28.2 | 6.783 | 240 | 31.8 | 7.767 | 244 | 35.4 | 9.096 | 257 | 39.5 | 10.590 | 268 |
| 2. KNR Freight | 1.4 | .226 | 161 | 1.4 | .229 | 164 | 1.7 | .292 | 172 | 1.3 | .218 | 168 | 1.3 | .193 | 148 | 1.6 | .246 | 154 | 1.5 | .247 | 165 | 1.6 | .260 | 163 | 1.7 | .273 | 161 |
| 3. Military Freight | 2.1 | .389 | 185 | 2.1 | .387 | 184 | 2.1 | .403 | 192 | 2.3 | .464 | 202 | 2.7 | .548 | 203 | 2.2 | .455 | 207 | 2.3 | .472 | 205 | 2.4 | .524 | 218 | 2.5 | .582 | 233 |
| 4. TOTAL | 20.3 | 4.522 | 223 | 22.3 | 5.043 | 226 | 23.9 | 5.450 | 228 | 27.4 | 6.178 | 225 | 28.8 | 6.865 | 238 | 32.0 | 7.484 | 234 | 35.6 | 8.486 | 238 | 39.4 | 9.880 | 251 | 43.7 | 11.445 | 262 |

T: Million Tn

TK: Billion Tn-Km

AD: Average distance: Km

Source: 1964-68 figures: KNR
1969-72: KNR revised by Bank mission

December 11, 1969

KOREA

THIRD RAILWAY PROJECT

KNR Passenger Traffic

(1964-68: Actual; 1969-72: Forecast)

| | 1964 | | | 1965 | | | 1966 | | | 1967 | | | 1968 | | | 1969 | | | 1970 | | | 1971 | | | 1972 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | P | PK | AD | P | PK | AD | P | PK | AD | P | PK | AD | P | PK | AD | P | PK | AD | P | PK | AD | P | PK | AD | P | PK | AD |
| 1. Commuters | 32.9 | .731 | 22.2 | 32.2 | .715 | 22.5 | 38.4 | .830 | 21.6 | 41.6 | .883 | 21.2 | 38.7 | .828 | 21.3 | 49.4 | 1.044 | 21.1 | 46.4 | 1.021 | 22.0 | 51.5 | 1.133 | 22.0 | 57.2 | 1.287 | 22.5 |
| 2. Long Distance | 83.8 | 6.107 | 72.8 | 73.3 | 5.710 | 77.8 | 98.0 | 7.288 | 74.3 | 108.4 | 8.150 | 75.2 | 110.6 | 9.280 | 83.9 | 120.6 | 9.741 | 80.7 | 131.6 | 10.657 | 80.9 | 139.5 | 11.549 | 82.7 | 146.8 | 12.553 | 85.5 |
| 3. Military | 1.9 | .515 | 271.0 | 1.8 | .482 | 267.7 | 1.9 | .546 | 287.3 | 1.9 | .543 | 288.9 | 1.6 | .482 | 301.2 | 2.0 | .578 | 289.0 | 2.0 | .578 | 289.0 | 2.0 | .578 | 289.0 | 2.0 | .578 | 289.0 |
| 4. Total | 118.6 | 7.353 | 62.0 | 107.3 | 6.987 | 64.5 | 138.3 | 8.664 | 62.6 | 152.0 | 9.576 | 63.6 | 151.0 | 10.590 | 70.1 | 172.0 | 11.363 | 66.0 | 180.0 | 12.256 | 68.0 | 193.0 | 13.260 | 68.7 | 206.0 | 14.418 | 69.0 |

P: Million Passengers

PK: Billion Passenger-km

AD: Average Distance: Km

Source: 1964-68 figure: KNR
1969-72 KNR, revised by Bank Mission

TABLE 5

December 11, 1969

KOREA

THIRD RAILWAY PROJECT

Summary of Operating Statistics (all traffic)

| | | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 |
|---|---|---|---|---|---|---|---|
| I. SYSTEM | | | | | | | |
| Route-km | km | 3,039 | 2,954 | 2,980 | 3,063 | 3,105 | 3,234 |
| II. TRAFFIC | | | | | | | |
| Pass. carried | million | 109.3 | 118.5 | 107.2 | 138.3 | 152.0 | 151.0 |
| Pass-km | million | 6,576 | 7,353 | 6,917 | 8,664 | 9,577 | 10,590 |
| Freight tons carried-Total | million | 19.8 | 20.3 | 22.4 | 24.1 | 27.4 | 28.9 |
| Freight net ton-km | million | 4,358 | 4,522 | 5,043 | 5,450 | 6,178 | 6,865 |
| Traffic units-Total | million | 10,934 | 11,875 | 11,960 | 14,114 | 15,755 | 17,455 |
| III. TRAFFIC DENSITY | | | | | | | |
| Pass-km per route-km | 000 | 2,164 | 2,489 | 2,321 | 2,829 | 3,084 | 3,275 |
| Freight net ton-km per route-km | 000 | 1,434 | 1,531 | 1,692 | 1,779 | 1,990 | 2,123 |
| IV. OPERATIONS | | | | | | | |
| Train-km by mode of traction | | | | | | | |
| Steam | 000 | 8,918 | 5,579 | 6,879 | 7,713 | 2,834 | 490 |
| Diesel | 000 | 13,149 | 16,275 | 17,002 | 17,924 | 23,455 | 28,183 |
| Railcars | 000 | 2,939 | 5,787 | 6,164 | 6,433 | 9,270 | 8,803 |
| Total | 000 | 25,006 | 27,641 | 30,045 | 32,070 | 35,559 | 37,476 |
| Engine-km | | | | | | | |
| Steam | 000 | 13,443 | 9,906 | 11,636 | 13,181 | 6,836 | 3,424 |
| Diesel | 000 | 15,546 | 19,116 | 19,088 | 21,208 | 29,742 | 35,539 |
| Railcars | 000 | 5,186 | 9,439 | 9,060 | 10,150 | 17,894 | 16,691 |
| Total | 000 | 34,175 | 38,461 | 39,784 | 44,539 | 54,472 | 55,654 |
| Number of engines in fleet | | | | | | | |
| Steam | | 280 | 272 | 272 | 242 1/ | 205 | 115 |
| Diesel | | 125 | 125 | 125 | 173 1/ | 238 | 252 |
| Railcar | | 81 | 80 | 77 | 163 2/ | 163 | 161 |
| Total | | 486 | 477 | 474 | 578 | 606 | 528 |
| Engine-km/engine-day in fleet | | | | | | | |
| Steam | km | 132 | 100 | 117 | 139 | 151 | 82 |
| Diesel | km | 341 | 419 | 417 | 428 | 380 | 386 |
| Railcar | km | 176 | 323 | 322 | 320 | 300 | 287 |
| Availability of diesel locomotives | % | 78 | 97 | 97 | 98 | 97 | 95 |
| Availability of diesel railcars | % | 50 | 86 | 85 | 58 2/ | 80 | 82 |
| Engine-km/engine-day Avail. | | | | | | | |
| Diesel | km | 455 | 433 | 431 | 436 | 393 | 411 |
| Railcar | km | 356 | 375 | 376 | 385 | 377 | 349 |

| | | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 |
|---|---|---|---|---|---|---|---|
| V. | OPERATING EFFICIENCY | | | | | | |
| | Traffic unit/engine unit in fleet 000,000 | 22.5 | 24.9 | 25.2 | 28.9 3/ | 31.5 | 33.2 |
| | Pass-km/train-km | 437 | 431 | 398 | 439 | 443 | 466 |
| | Pass-km/pass car in fleet 000,000 | 4.1 | 5.8 | 5.0 | 6.2 | 6.9 | 7.7 |
| | Pass-km/pass car-km | 62.0 | 59.2 | 54.4 | 62.9 | 63.7 | 68.7 |
| | Net ton-km/freight cars in fleet 000 | 416 | 422 | 476 | 495 | 510 | 519 |
| | Number of freight cars loaded 000 | 669 | 665 | 735 | 765 | 821 | 803 |
| | Average turn-around of freight cars day | 4.5 | 4.4 | 4.5 | 4.4 | 4.6 | 4.6 |
| | Average load of freight cars ton | 28.8 | 29.1 | 29.5 | 30.6 | 31 | 32 |
| VI. | STAFF EFFICIENCY | | | | | | |
| | Number of permanent employees | 26,218 | 27,639 | 29,548 | 29,976 | 33,413 | 35,192 |
| | Traffic unit/employee 000 | 417 | 429 | 405 | 471 | 472 | 496 |
| | Employees per route-km | 8.63 | 9.36 | 9.92 | 9.78 | 10.76 | 10.88 |
| | Number of employees per 1000 train-km | 1.05 | 1.01 | 0.98 | 0.94 | 0.94 | 0.94 |

1/ 48 locomotives delivered at varying times through 1966 gave equivalent of 10 additional locomotives in full year.
2/ 1 railcar rebuilt; 85 railcars delivered at varying times throughout 1966 gave equivalent of 18 additional railcars in full year.
3/ divisor of 487 (257 steam + 135 diesel + 95 railcars).

December 11, 1969

KOREA

THIRD RAILWAY PROJECT

1967-1971 Investment Plan (Summary)

| | 1967 - 1968 | | | 1969 | | | 1970 - 1971 (Project Period) | | | Total 1967 - 1971 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local W mil | Foreign US$ 000 | Total W mil | Local W mil | Foreign US$ 000 | Total W mil | Local W mil | Foreign US$ 000 | Total W mil | Local W mil | Foreign US$ 000 | Total W mil |
| 1. Construction of New Lines | 5506 | 635 | 5680 | 311 | - | 311 | 1254 | - | 1254 | 7071 | 635 | 7245 |
| 2. Increase in Station and Line capacity | 4839 | 1945 | 5370 | 4298 | 279 | 4379 | 9808 | 11349 | 13270 | 18945 | 13573 | 23019 |
| 3. Way and Structure Renewals & Improvements | 1627 | 802 | 1846 | 1201 | 3007 | 2073 | 1998 | 9704 | 4958 | 4826 | 13513 | 8877 |
| 4. Motive Power and Rolling Stock | 2853 | 33235 | 11243 | 1992 | 20728 | 8003 | 3917 | 55900 | 20969 | 8762 | 109863 | 40215 |
| 5. Rolling Stock Equipment & Construction | 682 | 54 | 696 | 327 | 1793 | 847 | 539 | - | 539 | 1548 | 1847 | 2082 |
| 6. Miscellaneous | 303 | 25 | 310 | 239 | 488 | 380 | 1441 | 3455 | 2495 | 1983 | 3968 | 3185 |
| 7. Total | 15810 | 36696 | 25145 | 8368 | 26295 | 15993 | 18957 | 80408 | 43485 | 43135 | 143399 | 84623 |
| 8. Contingencies | | | | | | | 3041 | 3322 | 4051 | 3041 | 3322 | 4051 |
| 9. Grand Total | 15810 | 36696 | 25145 | 8368 | 26295 | 15993 | 21998 | 83730 | 47536 | 46176 | 146721 | 88674 |

March 3, 1970

TABLE 7

KOREA

THIRD RAILWAY PROJECT

1967-1971 Investment Plan

(1967/68 Actual: 1969-71 Forecast)

| Items | Units During Period | TOTAL COST Local W million | TOTAL COST Foreign US$ 000 | TOTAL COST Total W million | 1967 (ACTUAL) Local W million | 1967 (ACTUAL) Foreign US$ 000 | 1967 (ACTUAL) Total W million | 1968 (ACTUAL) Local W million | 1968 (ACTUAL) Foreign US$ 000 | 1968 (ACTUAL) Total W million | 1969 Local W million | 1969 Foreign US$ 000 | 1969 Total W million | 1970 Local W million | 1970 Foreign US$ 000 | 1970 Total W million | 1971 Local W million | 1971 Foreign US$ 000 | 1971 Total W million |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Construction of new Lines | | | | | | | | | | | | | | | | | | | |
| i) Gyeong Jeon | | 2,416 | - | 2,416 | 1,721 | - | 1,721 | 695 | - | 695 | - | - | - | - | - | - | - | - | - |
| ii) Jeong Seon | | 1,238 | 209 | 1,296 | 422 | - | 422 | 476 | 209 | 534 | 74 | - | 74 | 266 | - | 266 | - | - | - |
| iii) Mun Gyeong | | 540 | 126 | 574 | 82 | - | 82 | 458 | 126 | 492 | - | - | - | - | - | - | - | - | - |
| iv) Bi In | | 136 | - | 136 | 36 | - | 36 | 12 | - | 12 | - | - | - | 29 | - | 29 | 59 | - | 59 |
| v) Jang Hang | | 415 | - | 415 | - | - | - | 15 | - | 15 | - | - | - | 150 | - | 150 | 250 | - | 250 |
| vi) Miscellaneous Industrial Spurs | | 2,150 | 300 | 2,232 | 224 | - | 224 | 1,189 | 300 | 1,271 | 237 | - | 237 | 263 | - | 263 | 237 | - | 237 |
| vii) Miscellaneous Low Priority Lines | | 176 | - | 176 | 176 | - | 176 | - | - | - | - | - | - | - | - | - | - | - | - |
| Sub Totals | | 7,071 | 635 | 7,245 | 2,661 | - | 2,661 | 2,845 | 635 | 3,019 | 311 | - | 311 | 708 | - | 708 | 546 | - | 546 |
| 2. Increase in Station and Line Capacity | | | | | | | | | | | | | | | | | | | |
| i) Seoul Area | | 5,917 | 1,296 | 6,285 | 444 | 836 | 642 | 775 | - | 775 | 1,534 | - | 1,534 | 1,654 | 200 | 1,715 | 1,540 | 260 | 1,619 |
| ii) Double Tracking | | 1,581 | 196 | 1,638 | 48 | - | 48 | 420 | 96 | 446 | 105 | - | 105 | 254 | - | 254 | 754 | 100 | 785 |
| iii) Marshalling and Station Yards | | 1,962 | 624 | 2,148 | 299 | - | 299 | 338 | 45 | 351 | 275 | 279 | 356 | 500 | 150 | 546 | 550 | 150 | 596 |
| iv) Loading and Offloading Facilities | | 3,322 | - | 3,322 | 317 | - | 317 | 872 | - | 872 | 1,548 | - | 1,548 | 263 | - | 263 | 322 | - | 322 |
| v) Electrification | | 2,699 | 8,289 | 5,227 | - | - | - | 45 | - | 45 | 237 | - | 237 | 950 | 2,000 | 1,560 | 1,467 | 6,289 | 3,385 |
| vi) Building Improvements and Enlargements | | 652 | - | 652 | 32 | - | 32 | 188 | - | 188 | 57 | - | 57 | 160 | - | 160 | 215 | - | 215 |
| vii) Signalling and Track Extensions | | 2,812 | 3,268 | 3,747 | 640 | 666 | 822 | 451 | 302 | 533 | 542 | - | 542 | 579 | 1,100 | 915 | 600 | 1,100 | 935 |
| Sub Totals | | 18,945 | 13,573 | 23,019 | 1,750 | 1,502 | 2,160 | 3,089 | 443 | 3,210 | 4,298 | 279 | 4,379 | 4,360 | 3,450 | 5,413 | 5,448 | 7,899 | 7,857 |
| 3. Way and Structure Renewals and Improvements | | | | | | | | | | | | | | | | | | | |
| i) Track (Bed, Ties, Rails) | | 4,362 | 10,000 | 7,341 | 688 | - | 688 | 877 | 802 | 1,096 | 1,127 | 3,007 | 1,999 | 895 | 3,000 | 1,810 | 775 | 3,191 | 1,748 |
| ii) Tunnels, Bridges and Structures | | 460 | 1,113 | 800 | 62 | - | 62 | - | - | - | 70 | - | 70 | 50 | 170 | 102 | 278 | 943 | 566 |
| iii) Equipment | | 4 | 2,400 | 736 | - | - | - | - | - | - | 4 | - | 4 | - | 200 | 61 | - | 2,200 | 671 |
| Sub Totals | | 4,826 | 13,513 | 8,877 | 750 | - | 750 | 877 | 802 | 1,096 | 1,201 | 3,007 | 2,073 | 945 | 3,370 | 1,973 | 1,053 | 6,334 | 2,985 |
| 4. Motive Power and Rolling Stock | | | | | | | | | | | | | | | | | | | |
| i) Locomotives | | 160 | 41,972 | 12,340 | 39 | 15,886 | 4,370 | 89 | 518 | 230 | 15 | 6,068 | 1,775 | 3 | 2,000 | 613 | 14 | 17,500 | 5,352 |
| ii) Passenger Cars 1/ | | 2,918 | 19,886 | 8,693 | 64 | - | 64 | 749 | 2,226 | 1,357 | 900 | 14,660 | 5,151 | 700 | 1,700 | 1,219 | 505 | 1,300 | 902 |
| iii) Freight Cars | | 5,354 | 46,505 | 18,442 | 1,235 | 735 | 1,435 | 677 | 12,370 | 3,377 | 1,077 | - | 1,077 | 1,148 | 14,500 | 5,571 | 1,217 | 18,900 | 6,982 |
| iv) Wrecking Cranes and Containers | | 330 | 1,500 | 740 | - | 1,368 | 374 | - | 132 | 36 | - | - | - | 330 | - | 330 | - | - | - |
| Sub Totals | | 8,762 | 109,863 | 40,215 | 1,338 | 17,989 | 6,243 | 1,515 | 15,246 | 5,000 | 1,992 | 20,728 | 8,003 | 2,181 | 18,200 | 7,733 | 1,736 | 37,700 | 13,236 |
| 5. Rolling Stock Equipment and Construction | | | | | | | | | | | | | | | | | | | |
| i) Sheds and Facilities | | 901 | - | 901 | 192 | - | 192 | 168 | - | 168 | 327 | - | 327 | 130 | - | 130 | 84 | - | 84 |
| ii) Plant and Equipment | | 647 | 1,847 | 1,181 | 144 | 54 | 158 | 178 | - | 178 | - | 1,793 | 520 | 325 | - | 325 | - | - | - |
| Sub Totals | | 1,548 | 1,847 | 2,082 | 336 | 54 | 350 | 346 | - | 346 | 327 | 1,793 | 847 | 455 | - | 455 | 84 | - | 84 |
| 6. Miscellaneous | | | | | | | | | | | | | | | | | | | |
| i) Communications | | 1,472 | 2,695 | 2,292 | 38 | - | 38 | 195 | - | 195 | 194 | 95 | 221 | 262 | - | 262 | 783 | 2,600 | 1,576 |
| ii) Electric Power and Lighting | | 264 | - | 264 | 15 | - | 15 | 43 | - | 43 | 20 | - | 20 | 90 | - | 90 | 96 | - | 96 |
| iii) Office Equipment, etc. | | 102 | - | 102 | 2 | - | 2 | - | - | - | - | - | - | 50 | - | 50 | 50 | - | 50 |
| iv) Consultant Services | | 145 | 1,273 | 527 | - | - | - | 10 | 25 | 17 | 25 | 393 | 139 | 55 | 635 | 249 | 55 | 220 | 122 |
| Sub Totals | | 1,983 | 3,968 | 3,185 | 55 | - | 55 | 248 | 25 | 255 | 239 | 488 | 380 | 457 | 635 | 651 | 984 | 2,820 | 1,844 |
| 7. Total | | 43,135 | 143,399 | 84,623 | 6,890 | 19,545 | 12,219 | 8,920 | 17,151 | 12,926 | 8,368 | 26,295 | 15,993 | 9,106 | 25,655 | 16,933 | 9,851 | 54,753 | 26,552 |
| 8. Contingencies 2/ | | 3,041 | 3,322 | 4,051 | - | - | - | - | - | - | - | - | - | 1,465 | 1,105 | 1,802 | 1,576 | 2,217 | 2,249 |
| 9. Grand Total | | 46,176 | 146,721 | 88,674 | 6,890 | 19,545 | 12,219 | 8,920 | 17,151 | 12,926 | 8,368 | 26,295 | 15,993 | 10,571 | 26,760 | 18,735 | 11,427 | 56,970 | 28,801 |

1/ includes 116 heater cars

2/ in 1970 and 1971 only

March 3, 1970

TABLE 8

KOREA

TABLE 2

THIRD RAILWAY PROJECT

Cash Flow Statement 1967-1971
(Won Billions)

| | 1967 | 1968 | 1969 | 1970 | 1971 | TOTAL 1970-71 (Project Period) | TOTAL 1967-71 (Plan Period) |
|---|---|---|---|---|---|---|---|
| | (ACTUAL) | | (FORECAST) | | | | |
| FUNDS REQUIRED FOR INVESTMENT PROGRAM | | | | | | | |
| Local Funds | 6.89 | 8.92 | 8.37 | 10.57 | 11.43 | 22.00 | 46.18 |
| Foreign Exchange | 5.33 | 4.00 | 7.62 | 8.17 | 17.37 | 25.54 | 42.49 |
| Total Funds Required | 12.22 | 12.92 | 15.99 | 18.74 | 28.80 | 47.54 | 88.67 |
| FUNDS AVAILABLE | | | | | | | |
| A. From KNR | | | | | | | |
| 1. Net Income before Interest | 2.82 | 7.12 | 6.65 | 11.82 | 8.40 | 20.22 | 36.81 |
| 2. Depreciation | 2.54 | 3.68 | 4.12 | 4.32 | 4.97 | 9.29 | 19.63 |
| 3. Gains on Sale of Assets | 0.13 | 0.45 | 0.57 | 1.25 | 1.25 | 2.50 | 3.65 |
| Less: | 5.49 | 11.25 | 11.34 | 17.39 | 14.62 | 32.01 | 60.09 |
| 4. Debt Service: | | | | | | | |
| Interest on Loans | 0.92 | 1.31 | 1.60 | 1.87 | 2.36 | 4.23 | 8.06 |
| Repayment of Loans | 0.38 | 0.89 | 2.43 | 2.93 | 3.29 | 6.22 | 9.92 |
| Total Debt Service | 1.30 | 2.20 | 4.03 | 4.80 | 5.65 | 10.45 | 17.98 |
| 5. Working Capital Increase (Decrease) | (1.23) | (0.32) | 0.06 | 3.48 | (2.33) | 1.15 | (0.34) |
| Net Funds Available from KNR | 5.42 | 9.37 | 7.25 | 9.11 | 11.30 | 20.41 | 42.45 |
| B. From Borrowing | | | | | | | |
| 1. Long-term: | | | | | | | |
| i) Existing Foreign Loans: | | | | | | | |
| AID III (USA) | 4.72 | 0.18 | 0.63 | - | - | - | 5.53 |
| CTC (UK) | 0.18 | 0.08 | - | - | - | - | 0.26 |
| OECF I (Japan) | 0.20 | - | - | - | - | - | 0.20 |
| OECF II (Japan) | - | 0.61 | - | 0.12 | - | 0.12 | 0.73 |
| IDA Credit 110-KO | - | 2.68 | 0.11 | 0.15 | - | 0.15 | 2.94 |
| Eximbank | - | - | 1.76 | - | - | - | 1.76 |
| Sub-Total | 5.10 | 3.55 | 2.50 | 0.27 | - | 0.27 | 11.42 |
| ii) Proposed Foreign Loans: | | | | | | | |
| CTC (Germany) | - | - | - | 0.36 | 0.36 | 0.72 | 0.72 |
| Proposed IBRD Loan | - | - | - | 4.54 | 12.23 | 16.77 | 16.77 |
| Loan for Electrification | - | - | - | 0.66 | 2.06 | 2.72 | 2.72 |
| Sub-Total | - | - | - | 5.56 | 14.65 | 20.21 | 20.21 |
| Total Foreign Loans | 5.10 | 3.55 | 2.50 | 5.83 | 14.65 | 20.48 | 31.63 |
| iii) Local Loans: | | | | | | | |
| Korean Reconstruction Bank | 1.70 | - | - | - | - | - | 1.70 |
| Korean Exchange Bank | - | - | 2.90 | - | - | - | 2.90 |
| Total Local Loans | 1.70 | - | 2.90 | - | - | - | 4.60 |
| 2. Short-term for: | | | | | | | |
| Rail | - | - | 0.87 | 0.98 | 1.05 | 2.03 | 2.90 |
| Passenger cars | - | - | 1.35 | - | - | - | 1.35 |
| Total short-term loans | - | - | 2.22 | 0.98 | 1.05 | 2.03 | 4.25 |
| From Borrowing | 6.80 | 3.55 | 7.62 | 6.81 | 15.70 | 22.51 | 40.48 |
| C. From Government | - | - | 1.12 | 2.82 | 1.80 | 4.62 | 5.74 |
| TOTAL FUNDS AVAILABLE (A & B & C) | 12.22 | 12.92 | 15.99 | 18.74 | 28.80 | 47.54 | 88.67 |

March 3, 1970

KOREA

THIRD RAILROAD PROJECT

Income Accounts 1964 - 1971

(Actual : 1964-1968)
(Forecast : 1969-1971)

(Won Billion)

TABLE 10

| | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 |
|---|---|---|---|---|---|---|---|---|
| | | ( A C T U A L ) | | | | | (FORECAST) | |
| **OPERATING REVENUE** | | | | | | | | |
| Passenger revenue | 5.32 | 6.57 | 8.38 | 10.68 | 15.49 | 18.59 | 25.45 | 27.42 |
| Freight revenue | 4.50 | 5.54 | 6.05 | 7.38 | 9.74 | 11.71 | 13.70 | 16.04 |
| Other operating revenue | 0.55 | 0.98 | 1.34 | 1.85 | 2.18 | 1.39 | 3.80 | 4.09 |
| Total operating revenue | 10.37 | 13.09 | 15.77 | 19.91 | 27.41 | 31.69 | 42.95 | 47.55 |
| **OPERATING EXPENSES** | | | | | | | | |
| Operating expenses before depreciation | 7.71 | 9.60 | 12.70 | 14.55 | 17.50 | 21.34 | 27.21 | 34.48 |
| Depreciation provision | 2.05 | 1.99 | 2.23 | 2.54 | 3.68 | 4.12 | 4.32 | 4.97 |
| Total operating expenses | 9.76 | 11.59 | 14.93 | 17.09 | 21.18 | 25.46 | 31.53 | 39.45 |
| Net operating revenue | 0.61 | 1.50 | 0.84 | 2.82 | 6.23 | 6.23 | 11.42 | 8.10 |
| Non-operating revenue/loss (net) | 0.55 | 0.16 | 0.32 | (0.09) | 0.89 | 0.42 | .40 | .30 |
| Net revenue before interest | 1.66 | 1.66 | 1.16 | 2.73 | 7.12 | 6.65 | 11.82 | 8.40 |
| Interest charges | 0.35 | 0.29 | 0.43 | 0.92 | 1.31 | 1.60 | 1.87 | 2.36 |
| Net revenue | 0.81 | 1.37 | 0.73 | 1.81 | 5.81 | 5.05 | 9.95 | 6.04 |
| **RATIOS:** | | | | | | | | |
| Operation ratio | 94 | 89 | 95 | 86 | 77 | 80 | 73 | 83 |
| Times interest earned | 3.3 | 5.7 | 2.9 | 3.1 | 5.4 | 4.2 | 6.3 | 3.6 |
| Debt coverage | 5.6 | 7.1 | 4.3 | 4.1 | 4.9 | 2.5 | 3.6 | 2.6 |
| Return on average net fixed assets in use (%) | N/A | 2.5 | 1.5 | 1.8 | 4.4 | 3.7 | 6.4 | 3.8 |

March 3, 1970

KOREA

TABLE 11

THIRD RAILWAY PROJECT

Balance Sheets as of December 31, 1966-1971

(Won billion)

| | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 |
|---|---|---|---|---|---|---|
| | ------ACTUAL---------- | | | ------FORECAST-------- | | |
| ASSETS | | | | | | |
| Fixed Assets: | | | | | | |
| Land, buildings, machinery & equipment | 89.0 | 171.0 | 181.5 | 197.5 | 216.2 | 245.0 |
| Less accumulated depreciation | 9.5 | 2.6 | 6.2 | 10.3 | 14.6 | 19.6 |
| Net fixed assets | 79.5 | 168.4 | 175.3 | 187.2 | 201.6 | 225.4 |
| Current Assets: | | | | | | |
| Cash | 0.2 | 0.2 | 0.2 | 0.2 | 1.1 | 1.2 |
| Inventories | 2.3 | 2.6 | 5.9 | 6.3 | 6.9 | 7.0 |
| Other current assets | 1.8 | 2.1 | 6.4 | 7.2 | 10.3 | 9.1 |
| Total current assets | 4.3 | 4.9 | 12.5 | 13.7 | 18.3 | 17.3 |
| Investments | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| Deferred assets | 2.6 | 2.5 | 2.8 | 1.9 | 0.9 | - |
| Total Assets | 86.5 | 175.9 | 190.7 | 202.9 | 220.9 | 242.8 |
| LIABILITIES | | | | | | |
| Equity | | | | | | |
| Fixed capital | 65.0 | 65.0 | 65.0 | 66.1 | 68.9 | 70.7 |
| Capital surplus | 3.1 | 78.4 | 76.6 | 76.6 | 76.6 | 76.6 |
| Earned surplus | 2.7 | 8.9 | 14.3 | 19.6 | 29.7 | 36.1 |
| Total equity | 70.8 | 152.3 | 155.9 | 162.3 | 175.2 | 183.4 |
| Debt | | | | | | |
| Foreign loans | 10.0 | 14.9 | 19.2 | 21.5 | 26.3 | 39.9 |
| Local borrowing | 1.9 | 3.6 | 3.6 | 6.5 | 5.7 | 4.5 |
| Total debt | 11.9 | 18.5 | 22.8 | 28.0 | 32.0 | 44.4 |
| Current liabilities | 3.8 | 5.1 | 12.0 | 12.6 | 13.7 | 15.0 |
| Total liabilities | 86.5 | 175.9 | 190.7 | 202.9 | 220.9 | 242.8 |
| RATIOS: | | | | | | |
| Current assets to current liabilities | 1.1 | 1.0 | 1.0 | 1.1 | 1.4 | 1.2 |
| Current assets less inventories to current liabilities | 0.5 | 0.5 | 0.5 | 0.6 | 0.8 | 0.7 |
| Debt to equity | 14/86 | 11/89 | 13/87 | 15/85 | 15/85 | 20/80 |

March 3, 1970

TABLE 12

KOREA

THIRD RAILWAY PROJECT

Composition of Debt as of December 31, 1968

| | Class of Loan | Year Contracted | US$ million equivalent | Won million | Repayment Period (years) | Rate of Interest | Amount Outstanding (Won millinn) |
|---|---|---|---|---|---|---|---|
| A. | FOREIGN | | | | | | |
| 1. | IDA Relending (25-KO) | 1962 | 14.0 | 3,759 | 25 | 5.75 | 3,044 |
| 2. | IDA Relending (110-KO) | 1967 | 11.0 | 3,003 | 25 | 6.0 | 2,682 |
| 3. | US AID I | 1962 | 6.4 | 1,735 | 21 | 5.75 | 1,389 |
| 4. | US AID II | 1965 | 10.7 | 2,875 | 21 | 5.75 | 2,584 |
| 5. | US AID III | 1966 | 18.5 | 4,760 | 15 | 5.75 | 3,787 |
| 6. | Japan (OECF) I | 1966 | 11.9 | 3,276 | 20 | 5.75 | 2,992 |
| 7. | Japan (OECF) II | 1966 | 9.3 | 2,570 | 20 | 5.75 | 2,445 |
| 8. | U.K. (C.T.C.) | 1965 | 1.4 | 320 | 15½ | about 7.0 | 320 |
| 9. | Export-Import Bank | 1968 | 6.0 | 1,760 | 7 | 6.0 | - |
| | Total Foreign Loans | | 89.2 | 24,058 | | | 19,243 |
| B. | LOCAL | | | | | | |
| 10. | Korean Reconstruction Bank | 1966 | 13.0 | 3,571 | 25 | 6.0 | 3,571 |
| 11. | Korean Exchange Bank | 1968 | 10.0 | 2,800 | 4 | 6.5 | - |
| | Total Local Loans | | 23.0 | 6,371 | | | 3,571 |
| | GRAND TOTAL | | 112.2 | 30,429 | | | 22,814 |

March 3, 1970

KOREA

THIRD RAILWAY PROJECT

Government Agencies Dealing with Transport

1. The Ministry of Transportation (MOT) is responsible for railroad and civil aviation infrastructure works. It fully controls transport operations for all modes, issues regulations, delivers licenses, performs cost calculations, sets rates and fares, collects transport statistics and undertakes research. It carries out its activities through four bureaus - Land Transportation, Marine Transportation, Civil Aviation and Tourism - and exerts control over KNR.

2. The Ministry of Construction (MOC) is responsible for planning, construction and maintenance of highways and ports. It controls the Korean Highway Corporation, created in January 1969, which is in charge of constructing, maintaining and operating toll roads.

3. The Economic Planning Board (EPB) reviews and makes final decisions on transport investment programs. The Deputy Prime Minister who is Chairman of EPB is advised by the Economic Plan Committee (EPC). EPC is chaired by the Vice-Minister of EPB and is formed by Vice-Ministers of major ministries and other specially appointed members. Within the EPC, the Transportation and Communications Committee (further subdivided into two subcommittees) is in charge of appraising projects submitted by the ministries and agencies.

4. The Ministry of Agriculture and Forestry (MAF) is responsible for farm and forestry roads.

5. The Ministry of Commerce and Industry (MOCI) is responsible for promoting and supervising the assembling industries for motor vehicles, railway rolling stock and shipbuilding.

6. The Ministry of Finance (MOF) is responsible for establishing and collecting taxes in relation to transportation.

7. The Ministry of Home Affairs (MOHA) is the supreme head of all local government; it administers various taxes, such as the vehicle and the acquisition tax to help finance transport works by local authorities. MOHA is also in charge of the highway police.

8. To solve current problems the Government recently created two committees: the Committee Ad Hoc for Planning Overall Transport Measures (CAH) and the Transportation Coordination Committee (TCC).

(a) The CAH, created in June 1968, was to propose measures concerning the general transportation policy. Its members are the ministers of MOT, MOC, MOCI and a member of the Economic and Scientific Council. It is chaired by the Deputy Prime Minister, and a Minister without portfolio is acting as executive secretary with a small staff. This committee has produced no significant results.

(b) The TCC is also composed of representatives of various ministries and is chaired by the Vice-Minister of MOT. Its tasks are to solve urgent problems arising from considerable arrears in transport of basic goods such as coal, fuel, grain, fertilizer, cement and military goods. KNR has to observe the priorities fixed by the TCC for the allocation of freight cars.

November 15, 1969

KOREA

THIRD RAILWAY PROJECT

Draft Terms of Reference

Consultants for Diesel Motive Power Maintenance and Workshops Requirements

## I. PREAMBLE

It has been agreed between the International Bank for Reconstruction and Development and the Korean Government that Consultants will be engaged to undertake assignments as outlined in these terms of reference for the Korean National Railroad (KNR). The Consultants will carry out the assignments with the full cooperation of the Korean Government and of KNR. The Consultants will perform all economic, financial, organizational and technical studies as necessary to achieve the objectives set forth. The Consultants will be solely responsible for the analysis and interpretation of all data received or collected and for the conclusions and recommendations contained in their report.

## II. STUDIES

1. Diesel motive power maintenance

(i) Objectives: The purpose of this study is to ensure that the Korean National Railroad (KNR) obtains the advantage of most recent technical experience in the maintenance and repair of diesel locomotives and diesel railcars. This study is to improve availability of diesel railcars from the present 82% towards 92% and to help diesel locomotives to give a better quality of service by reducing the rate of failure from the present 25 casualties towards 10 per million-km.

(ii) Scope: The study will include:

(a) definition of periodic maintenance cycles adapted to the various series of diesel locomotives, and to the railcars.

- visits, checks, periodic inspections, to be performed by driving personnel or at servicing points (depots),

- overhauls and periodic revisions, generally to be performed in workshops,

- criteria of intervention: time or kilometrage;

(b) consistency of each maintenance operation defined above, i.e. nature, quantity, and quality of work to be done at each motive power unit;

(c) organization of maintenance and repair work at workshop level in order to perform each operation in the most efficient manner, time criteria being the most important; review of adequacy of existing facilities at workshop level for each operation and recommend improvements;

(d) setting up of a planned maintenance program at management level, in order to perform periodic maintenance in the most efficient and economical manner;

(e) setting up of a coordinated spare parts supply policy;

(f) setting up of a training program for maintenance at the various levels required:

- execution of maintenance and repair work

- troubleshooting

- supervision, control, investigations.

NOTE: - recommendations that involve expenditure should be quantified, divided between local and overseas funds, and programmed over a period of time.

2. Workshops

(i) Objectives: The purpose of this study is to review the existing workshops with respect to maintenance and manufacturing operations, present and future, to be performed on motive power and rolling stock, and to examine the opportunity to build a new workshop at Dae Jeon.

(ii) Scope: The study will include:

(a) examination of the adequacy of existing workshops in relation to present maintenance operations and semi-manufacturing of rolling stock:

(b) examination of the possibilities to increase production, in order to meet future demand, by improving organization, by specializing of workshops, and by limited extensions;

(c) recommendations on improvements required to existing workshops;

(d) examination of the new workshops proposal at Dae Jeon, and recommendations as to the opportunity to build it.

NOTE: - recommendations that involve expenditure should be quantified, divided between local and overseas funds, and programmed over a period of time.

## III. REPORTS

The Consultants shall submit 10 copies in English to the Republic of Korea and KNR and 5 copies in English to the International Bank for Reconstruction and Development, of the following reports:

(1) An inception report, outlining the methodologies proposed and the program of operations for their staff.

(2) Progress reports at three-months' intervals, dating from submission of the inception report, summarizing interim findings and indicating any special problems encountered in the course of the studies.

(3) A draft final report, summarizing all findings, conclusions and recommendations of the Consultants, together with statements, graphs, drawings and plans as may be required.

(4) A final report, reflecting the comments received from the Republic of Korea, KNR and the International Bank for Reconstruction and Development on the draft final report.

## IV. DATA AND LOCAL SERVICES TO BE PROVIDED BY THE REPUBLIC OF KOREA AND KNR

The Republic of Korea and KNR will make available to the Consultants all relevant data, reports, schedules, maps, plans and other information necessary for the efficient execution of the studies and shall cooperate fully.

KNR will have primary responsibility for all operational arrangements relating to the studies and for the assignment of full-time counterpart personnel to assist in obtaining information and to observe and make themselves fully conversant with the methods, principles and techniques of the studies.

In addition to the counterpart personnel, KNR will make available to the Consultants the necessary staff, including interpreters and translators, required for the collection and processing of data and the preparation of reports.

KNR will also provide the Consultants with the following facilities and equipment:

(1) Office space (to be defined).

(2) Office utilities, equipment and supplies (to be defined).

(3) Vehicles for use by the Consultants' staff and/or payment of transportation expenses within Korea.

KNR will also assist the Consultants in locating suitable living accommodations for their personnel and dependents.

## V. PROVISIONAL TIME SCHEDULE

The Consultants shall mobilize their key personnel for this study within 30 days of the date of the contract under which they shall be retained.

The inception report shall be submitted within 90 days of the date of such contract.

The draft final report shall be submitted within 8 months of the date of such contract.

The Republic of Korea, KNR and the International Bank for Reconstruction and Development shall submit their comments on the draft final report within 45 days of submittal of such report.

The final report shall be submitted within 60 days of receipt of comments from the Republic of Korea, KNR and the International Bank for Reconstruction and Development on the draft final report.

KOREA

THIRD RAILWAY PROJECT

Electrification of 348.6 km of Single-Track Lines
Connecting Seoul to the Northeast of Korea

1. Development of the fast growing cement industry in the North-eastern part of Korea, together with the anthracite coal and iron ore mines, builds up heavy traffic between this area and Seoul. Situated in mountainous country with no highway connections at present, this part of Korea is linked to Seoul by some 350 km of single track railway divided into three lines: Seoul (Cheong Ryang Ri) - Je Cheon (known as the Jung Ang line); Je Cheon - Go Han (known as the Tae Baeg line); and Hwang Ji - Baeg San and Cheol Am - Bug Pyeong (known as the Yeong Dong line). Though occupying, in route kilometrage, only a little over 10% of the entire network, these lines are important as they carry about 40% of KNR's total freight traffic: almost all anthracite coal (the largest single category of freight, accounting for 10 million tons per year), and cement (the second largest category of freight, about 3 million tons a year).

2. Total freight carried on these lines in 1968, and that forecast, are as follows:

| Lines | million of net tons | | | |
|---|---|---|---|---|
| | Actual | Forecast | | |
| | 1968 | 1971 | 1976 | 1981 |
| Jung Ang | 7.17 | 11.54 | 12.3 | 13.10 |
| Tae Baeg | 2.80 | 9.22 | 10.6 | 11.0 |
| Yeong Dong | 0.9 | 3.2 | 3.25 | 3.3 |

Traffic is mainly flowing from East to West, with much empty return haulage, giving at present a 2.15 ratio of $\frac{\text{gross-ton-km}}{\text{net-ton-km}}$

3. The three sections of line contain sharp curvatures of 250 m and 400 m, and 101 tunnels throughout the existing 335 route-km. The ruling grades (not compensated for curves) in the direction of loaded trains are 1.25% for 16 km on Jung Ang line, 2.50% for 7 km on Tae Baeg line and 3.0% for 51 km on Yeong Dong line.

4. Various measures have been taken to increase the capacity of the lines such as assignment of 1800-hp diesel locomotives, installation and lengthening of crossing loops, and, since October 1968, centralized traffic control (CTC) on Jung Ang line between Seoul (Mang U) and Bong Yang (148 km). However, with the present train speeds and distances between stations, the number of trains cannot be increased satisfactorily and the capacity only meets the demand. The present situation is as follows:

| Line | Maximum Number of trains per day per direction | Passenger: Number of trains per day per direction | Passenger: G. Tonnage Tons | Passenger: Average Speed km/h | Freight: Number of trains per day per direction | Freight: G. Tonnage Tons | Freight: Average Speed km/h | Transportation capacity Million Net Tons |
|---|---|---|---|---|---|---|---|---|
| Jung Ang | 34 | 9 | 600 | 33.7 | 25 | 1740 | 24.7 | 9.3 |
| Tae Baeg | 20 | 5 | 300 | 27.4 | 15 | 740 | 19.3 | 2.8 |
| Yeong Dong | 18 | 3 | 300 | 30.7 | 15 | 650 | 21.3 | 2.0 |
| | | | | | | Total | | 14.1 |

Since the main commodity is anthracite coal loaded in the open and carried in open cars (gondolas or hoppers), water retention occurring in the winter increases the weight of trains and reduces the transportation capacity by 4 to 5 trains daily. There are also many diesel engine failures due to overheating because of the long periods requiring sustained heavy power. The 24.5-ton axle load of the largest diesel locomotives causes excessive wear and damage to the track and makes track maintenance difficult and expensive.

5. To meet growth of traffic, KNR is faced with increasing the transportation capacity of the three lines. Theoretically, this can be obtained (a) by increasing the train loads/lengths (at same speed), (b) by double tracking, or (c) by increasing the train speeds (at same load).

(a) Train lengths cannot be increased over the present standard of 40 to 50 cars per train mainly because of limitations related to the automatic couplers and braking requirements in the long descending grades. It would also be very costly to increase the length of crossing loops at many stations.

(b) Double tracking, because of the difficulty of the terrain, would require a long period to carry out and would be extremely costly - US$230,000 to 280,000 per km, according to present estimates.

(c) To run trains at the required speed to meet the traffic demand without double tracking cannot be done economically by diesel traction. Multi-unit diesel operation in single track tunnels is liable to result in overheating of diesel engines and failures; alternatively the power of the diesel units has to be severely reduced. This factor would mean the employment of an excessive number of diesel locomotives.

6. In these circumstances and based on a Japanese study 1/, KNR has decided to electrify the total route-km of single track line:

| | |
|---|---|
| Jung Ang line | 155.2 km |
| Tae Baeg line | 107.9 km |
| Yeong Dong line | 85.5 km |
| | 348.6 km |

The Yeong Dong line includes the proposed 13-km connection (including a 4.5-km tunnel) between Go Han - Hwang Ji, which will shorten the hauling distance between East-West by about 50 km.

7. The entire project, including ground facilities, motive power, and construction of the proposed connecting line, is estimated to cost about US$63 million equivalent. Ground facilities, i.e. substations, overhead wire, modification of signal and communication equipment, is estimated to cost an average of US$66,000 per km. It is estimated that the total work can be completed in about three years. Electric traction will give the following transportation capacity:

| | Total Number of trains per day per direction | Passenger | | | Freight | | | Transportation capacity Million net-tons |
|---|---|---|---|---|---|---|---|---|
| Line | | Number of trains per day per direction | G. Tonnage Tons | Average Speed km/h | Number of trains per day per direction | G. Tonnage Tons | Average Speed km/h | |
| Jung Ang | 50 | 12 | 600 | 65 | 38 | 1740 | 49 | 14.2 |
| Tae Baeg | 40 | 7 | 600 | 55 | 33 | 1520 | 45 | 11.0 |
| Yeong Dong | 30 | 7 | 600 | 55 | 23 | 1520 | 39 | 7.4 |
| | | | | | | Total | | 32.6 |

8. Korea Electric Company has been installing large capacity thermal plants and therefore sufficient electric power is available for the intended electrification. A 154-kv transmission line is running close to the KNR route to be electrified, and doubling of this transmission line is planned in the near future. The present average rate per kwh, W 2.75 to 3.25, should not change in the foreseeable future (10 years), under present economic conditions.

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1/ Report on the result of study for electrification of industrial lines. December 1967 - Japan Railway Technical Service - Tokyo.

9. KNR has selected a 25-kv, ac, 60-hz electrification system which requires the least cost for ground facilities and gives the best motive power possibilities (adhesion) in this difficult and rugged area. Freight traffic would be handled by 66 locomotives: 3,900-kw, BBB type, 22-ton axle load. Their daily performance is expected to be 350 km. Maintenance is scheduled at Je Cheon, centrally located for the electrified lines, where a suitable building is already available.

10. Passenger traffic would have to be handled mostly by diesel locomotives and railcars; later it might become advisable to obtain some 2500-kw electric locomotives for this purpose. The 66 electric locomotives should release about 100 diesel locomotives needed (a) to phase out steam and (b) to take care of traffic increase.

11. The investment for electrification can be estimated at about US$63 million equivalent, of which about US$47 million is foreign exchange. About US$22 million is for general facilities (of which US$12 million foreign exchange), about US$35 million (all foreign exchange) for motive power (66 electric locomotives estimated at US$495,000 c.i.f., spare parts and special tools), and about US$6 million equivalent (with no foreign exchange) for the 13-km link line.

12. KNR has negotiated a loan, amounting to about US$57 million equivalent for the electrification project, with a consortium of European manufacturers (Belgium, France, Germany, Switzerland) on satisfactory terms. The loan is now awaiting ratification by the Governments involved. Construction work is expected to start in 1970 and electric traction to become effective by 1973.

13. Assuming the effective date of the contract to be about July 1, 1970, expenditure during 1970 and 1971 is estimated to be as follows:

| | 1970 | | | 1971 | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| | Local W mil | Foreign $ 000 | Total W mil | Local W mil | Foreign $ 000 | Total W mil | Local W mil | Foreign $ 000 | Total W mil |
| i) Ground facilities: | | | | | | | | | |
| Jung Ang line | 350 | 2,000 | 960 | 677 | 3,914 | 1,871 | 1,027 | 5,914 | 2,831 |
| Tae Baeg line | - | - | - | 190 | 950 | 480 | 190 | 950 | 480 |
| Yeong Dong line | - | - | - | - | - | - | - | - | - |
| ii) Connecting Link and Tunnel | 600 | - | 600 | 600 | - | 600 | 1,200 | - | 1,200 |
| iii) Locomotive shed (equipment) | - | - | - | - | 125 | 38 | - | 125 | 38 |
| iv) Locomotives (down payment) | - | - | - | - | 1,200 | 366 | - | 1,200 | 366 |
| v) Technical assistance | - | - | - | - | 100 | 30 | - | 100 | 30 |
| | 950 | 2,000 | 1,560 | 1,467 | 6,289 | 3,385 | 2,417 | 8,289 | 4,945 |

14. To handle the equivalent traffic with diesel traction would require an investment of about US$40 million in motive power (not taking into account the technical problems mentioned above).

15. Electrification as compared with diesel traction will result in a yearly operating saving of about US$1 million equivalent on the basis of 1973 traffic, and of about US$1.5 million equivalent on the basis of 1981 traffic. The expected rate of return is of the order of 20%.

March 3, 1970

KOREA

THIRD RAILWAY PROJECT

KNR's Investment Plan 1967 - 1971

I. Main Amendments to the Original 1967-1971 Plan as now agreed between KNR and the Bank

| | Increase (Decrease) | |
|---|---|---|
| | Local cost W billion | Foreign Cost US$ million |
| 1. Construction of New Lines: addition of five industrial spurs (35 km) | 2.4 | 3.9 |
| 2. Increase in Station and Line Capacity: the first phase of an electrification program for 350 km of line, expansion of freight handling facilities, improved operating facilities in the Seoul area, double tracking of 97 km of line, and improvements to marshalling yards | 11.1 | 10.3 |
| 3. Way and Structures: replacement of 37-kg/m rail by 50-kg/m rail, strengthening of bridges, and provisions for more mechanized track maintenance equipment | 1.4 | 5.8 |
| 4. Motive Power and Rolling Stock: acquisition of more diesel locomotives (and fewer rail cars), importation of 236 passenger coaches, and acquisition of more freight cars | (9.4) | 4.4 |
| 5. Rolling Stock Equipment and Construction: deferment of Dae Jeon workshops | 0.5 | 0.2 |
| 6. Miscellaneous: improvements to telecommunications | 1.4 | 2.4 |
| 7. Contingencies | 0.6 | 2.8 |

II. Main Items of the Revised 1967-1971 Plan
(about W 90 billion - see para. 4.02)

1. Construction of New Lines (9% of total expenditure):

- 80 km of single track between Jin Ju and Sun Cheon, begun under the 1962-1966 program, to improve access from the West of Korea to the main port of Pu San;

- 36 km, in two lines, to serve coal mines

- 38 km, in two lines, to interconnect developing industrial areas;

35 km, in five industrial spurs.

Total 189 km

Work has been suspended in 1967 on the construction of five "non-program" lines.

2. Increase in Station and Line Capacity (28% of total expenditure):

- first phase of an electrification program for 350 km of single-track lines connecting Seoul to the northeastern part of Korea, to serve fast growing cement industry, and construction of a 13-km connection between two of these lines;

- the expansion and remodeling of the present Seoul station as an exclusive passenger station by removing freight handling, car inspection and related activities to the Yongsan station which is to be improved to handle 3 million tons per year; a similar project in the present Pu San stations; a new freight yard at Cheong Ryang Ri, east of Seoul, to handle 2 million tons per year; a new marshalling yard at Je Cheon capable of handling about 1,400 cars a day and a new freight yard in Yeong Deung Po, south of Seoul. All the works are necessary to specialize the terminals and yards and to provide additional handling capacity in order to meet traffic requirements. At the moment these facilities are inadequate and reduce the efficiency of operations. The projected works, in addition to solving present obstacles, would permit the absorption of the new rolling stock included in the program which otherwise would be deficiently utilized. The incremental investment in freight handling facilities is included in the economic justification of additional freight cars to be financed under the proposed loan/credit (see Annex 9, para. 1).

- double tracking of part of Seoul-In Cheon and of Dae Jeon-Iri lines (97 km);

- installation of improved signalling, includes the installation of CTC in the Seoul area. This is required to increase the speed, to run more trains per day and to improve the quality of the service and the safety of operations;

- lengthening of crossing loops.

3. Way and Structure Renewals and Improvements (10% of total expenditure):

- relaying of about 1,000 km of track with 50 kg/m rail, with benefits accruing from the use of heavier more powerful diesel locomotives, longer trains and increased train speeds;
- replacement of wooden ties by concrete ties;
- strengthening of bridges;
- acquisition of mechanical track maintenance equipment to speed up and improve quality of maintenance.

4. Motive Power and Rolling Stock (44% of total expenditure):

- procurement of 159 diesel locomotives, 236 passenger coaches, and 4,585 freight cars;
- local building of 410 passenger coaches and 2,640 freight cars.

5. Rolling Stock Maintenance Facilities (1% of total expenditure):

- modernization of sheds and workshops.

6. Miscellaneous (5% of total expenditure):

- installation of a modern telecommunications system;
- improvement to electrical supply equipment;
- employment of consultants;
- training of KNR staff.

## III. Freight Stock Requirements in 1971

1. The 1968 freight stock comprised 13,239 cars. With a traffic of 6,865 million net ton-km, the yearly output per car in stock was 519,000 ton-km, and 575,000 ton-km 1/ per car available (availability 90%).

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1/ On the basis of the most recent information available in the Bank, freight car productivity figures expressed in ton-km per serviceable car for some other railways were as follows: France: 210.000; Argentina 265.000; Japan 408.000.

2. KNR's estimates for 1970 are 15,500 cars. With a traffic forecast of 8,486 million net ton-km for that year, the yearly output per car in stock would be 547,000 ton-km; this productivity figure is satisfactory and no substantial increase can be expected in the near future.

3. With a 1971 traffic forecast of 9,880 million net ton-km, freight car requirements can be estimated at about 17,000 units. The following breakdown of requirements can be made:

| | 1968 Stock | 1971 Requirements | Shortage 1971 over 1968 | Loan/credit items |
|---|---|---|---|---|
| Miscellaneous (including box and other cars) | 4,482 | 7,300 | 2,800 | 2,100 |
| Gondola cars | 3,966 | 3,600 | - | - |
| Hoppers cars (coal, ore, ballast) | 1,666 | 2,300 | 640 | 300 |
| Tank cars | 1,826 | 1,800 | - | - |
| Flat and other cars | 1,299 | 2,000 | 700 | 340 |
| | 13,239 | 17,000 | | 2,740 |

Shortage 1971 over 1968 amounts therefore to about 3,800 cars, which would rise to about 4,250 if cars were scrapped during that period.

4. KNR's proposal included the latter number of cars of which 2,740 are to be financed by the proposed loan/credit.

March 3, 1970

KOREA

THIRD RAILWAY PROJECT

Proposals for Telecommunication Equipment

There has been extended development of an independent railway telecommunications network, for both operational and administrative control, but this has been done with little or no coordination with the Ministry of Communications (MOC). An examination of KNR's existing facilities showed that much of the plant is life expired and is in very poor condition. Operations are being hampered by the many failures and breakdowns occurring, and the need for improved facilities with greater reliability is obvious.

A program has been outlined, in conjunction with KNR, for modernizing and developing the railroad's communications network, which would form a suitable basis for Bank financing. This program, which is given below, takes care of the first priority requirements, but must, in certain details, be regarded as provisional, until consultants' studies and recommendations are available.

Program for Telecommunications Expansion

| | Item | Estimated Cost US$ |
|---|---|---|
| 1. | Microwave and/or coaxial cable systems (with intersticed pairs) between Seoul-Dae Jeon-Pu San, equipped for 180 circuits in the first section and 120 channels in the second section | 1,950,000 |
| 2. | Yong San new 3,000-line automatic exchange and manual board, and Pu San new 1,000-line automatic exchange and manual board | 650,000 |
| 3. | Employment of consultants | 200,000 |
| 4. | Contingencies | 260,000 |
| | Total | 3,060,000 |

In order to finalize the proposals, carry out the detailed engineering design, and also rationalize future plans for expansion of KNR's communications network, it is considered essential that KNR should obtain expert advice through the employment of consultants. Technical details are given below:

Item 1: The existing overhead route is over 60 years old and, despite renewals of poles and arms in certain sections, is not in adequate condition

to provide reliable communications. The pole renewals which have been effected have generally been cases of isolated poles which have failed due to rot. Certain sections have been rebuilt at stations where additional carrying capacity is necessary. These total no more than 50 of the 450 km. Serious interference problems exist between Seoul and Dae Jeon and near Pu San due to parallelism with a high voltage transmission line. With the exception of the four 12-channel and five low-capacity systems, all carrier systems in use are outdated US Army Signal Corps equipment which should be replaced. To provide additional line wires or expand the use of the present carrier systems would involve very extensive and costly rebuilding with the provision of additional transposition points. In any case, the electrification of this section of railway line is ultimately contemplated, and if this should come about it would make the open wire communications line unworkable except for circuits over relatively short sections.

There are a number of possible alternatives for the provision of a modern wideband system. A microwave system would take care of the main centers, but the means of providing for intermediate points, possibly by use of VHF spurs, requires further investigation, particularly in the light of possible electrification. Cost studies of possible alternatives, such as a coaxial cable system with audio pairs, are desirable before a decision is reached. The facts that MOC is increasing the size of its microwave system and providing a coaxial cable system from Seoul to Pu San should also be considered with a view to possible coordination in the provision and use of facilities; the high cost of guarding microwave stations against saboteurs, which MOC has found necessary for its stations, should be taken into account. In the light of these considerations, the consultant should recommend on the system to be adopted and should prepare the final design.

Item 2: The present Yong San exchange has a capacity of 2,000 lines. The initial 500 lines of Strowger equipment which would normally be expected to have a life of from 20-25 years were installed in 1937, are worn out, and in very bad condition. Extensions of 600 lines provided in 1952, and 400 lines provided in 1954 are in only fair condition and must be considered as nearing the end of their useful life; only the extension of 500 lines provided in 1962 is in reasonably good condition. The accommodation is not adequate and serious dust conditions exist despite every precaution taken by the communications section. Replacement of this exchange in adequate accommodation at the most suitable location as related to pending moves of offices is a matter of urgent necessity. Some equipment, particularly the last extension, could usefully be reused for re-installation elsewhere, possibly to extend Dae Jeon. The 14-position manual board dates from 1933, is also worn out, and needs replacement in new accommodation.

The 600-line Pentaconta exchange at Pu San was installed only in 1959 and is in good condition. The regional bureau and certain of the operations sections are scheduled to move in 1970 to the new South Station some three miles away. Cost of a new 1,000-line exchange, including manual

board, is estimated at US$250,000 (US$200,000 foreign exchange); cost of extending all circuits to the present exchange after the move has not been calculated but might amount to US$100,000. The existing exchange accommodation is inadequate, but limited expansion is possible. There are obvious administrative advantages in moving the exchange. A tentative provision for financing has been made subject to theoretical and practical center studies and a recommendation by the consultant.

## Traffic Justification

Traffic Records:

1. Telegraphs

| Year | Messages | % Increase |
|---|---|---|
| 1965 | 7.2 million | - |
| 1966 | 9.8 million | + 36 |
| 1967 | 10.4 million | + 6.1 |
| 1968 | 10.0 million | - 3.8 |

Average increase: + 12% per annum.

2. Telephones

Records on Subscriber Trunk Dial (STD) calls are not maintained, so useful figures are not available.

3. Passenger Traffic

Average increase in total passenger-km over 8-year period, 1959-1967, is 10.1% per annum.

4. Freight Traffic

Average increase in total ton-km over 8-year period, 1959-1967, is 9.2% per annum.

Main line route, Seoul-Pu San, circuit requirements:

### Existing Route Capacity

| | Physical pairs | Phantoms | Carrier | Total |
|---|---|---|---|---|
| Yong San-Dae Jeon | 16 | 4 | 52 | 72 |
| Dae Jeon-Dae Gu | 14 | 3 | 43 | 60 |
| Dae Gu-Pu San | 16 | 3 | 37 | 56 |

Some overloading exists on the main telephone routes with delays up to two hours in obtaining connections. KNR estimates that an additional 20-30 circuits are required on each section to reduce delays to reasonable proportions and allow STD to operate, i.e. present circuit requirements Yong San-Dae Jeon: say 100; and Dae Jeon-Pu San, 80. If traffic is growing at 10% p.a., requirements by the time of commissioning of new system (3 years) will be: Seoul-Dae Jeon, 133; Dae Jeon-Pu San, 106. To allow for further growth, it is proposed to initially equip for 180 and 120 channels, respectively.

October 15, 1969

KOREA

THIRD RAILWAY PROJECT

Draft Terms of Reference for Communications Consultants

The consultants will be employed to examine and report on the following points:

Phase I

(i) The justification for a separate KNR wideband system between Seoul and Pusan or, alternatively, use of shared facilities with MOC on a rented or joint project basis. If a separate system is considered justified, recommend on whether microwave or coaxial cable facilities should be provided in the light of present value cost studies and the individual advantages offered by each system. If joint usage is supported, a recommendation on a basis for such joint usage equitable to both the parties concerned should be made; i.e. rental, joint ownership, etc.; proposed arrangements for maintenance and operation should be outlined. Any operational disadvantages to either KNR or MOC in the use of joint facilities should be outlined.

(ii) A theoretical/practical center study for locating the new exchange at Yong San.

(iii) The justification for a new exchange at the new Regional Bureau/South Station, Pusan, based on theoretical/practical center studies and possible use of the existing exchange elsewhere.

Phase II

(i) The adequacy of the existing communications network and the need for the additional and improved facilities as related to the expansion and growth of the rail system.

(ii) The adequacy of the present communications sections organization, personnel training needs, and other possible measures to improve efficiency.

(iii) The arrangments to be adopted for the most efficient and coordinated use of the communications network by all departments and functions of KNR.

(iv) The degree of future integration with the MOC network which may be desirable, and how far this may be of advantage or otherwise in increasing reliability and reducing the cost of provision of facilities required by KNR.

(v) The proposed overall development plan in the light of the above considerations; the establishment of proper priorities and a time schedule for the development of the communications network related to the state of the existing plant and the need for replacement in order to ensure reliability; the establishment of a program for other replacements not covered in the development program; a review of life histories and depreciation provisions.

(vi) A broad initial review of the pattern of development taking into account the problems likely to arise in connection with electrification.

(vii) The detailed plan for automatization of the KNR telephone network and the extension of long-distance dialing facilities; the use of imported crossbar telephone switching instead of locally produced step-by-step equipment.

(viii) The proposed extension of the VHF communications network.

October 15, 1969

ANNEX 7

KOREA

THIRD RAILWAY PROJECT

Coal Transport Study

1. A comprehensive survey on coal transportation and distribution was made in 1967/1968 by consultants (SOFRERAIL-SOFREMINES, France) financed under Credit 110-KO at a cost of US$25,000 equivalent. The consultants' final report was published in August 1968.

2. Efficient coal transportation in Korea is presently prevented by the extreme dispersion of coal shipping and receiving stations, and by the inefficient organization of coal mines and briquet manufacturers.

3. In the field of railroad transportation, the main difficulties arise from (a) a lack of adequate loading and unloading facilities (which ought to be provided by the mines and briquet manufacturers), preventing KNR from taking advantage of modern equipment such as coal hopper cars and resulting in unsatisfactory car turn-around time (4.9 days); (b) the method of shipment in single cars instead of complete train sets - resulting in high transportation costs due to heavy switching operations and long standing time in shipping and receiving stations; (c) the present rate structure, giving no incentive to transportation by complete train sets.

4. The consultants' report puts forward many useful and practical suggestions for solving or easing these problems. In many cases, the carrying out of the consultants' recommendations would result in considerable financial benefits. Thus, in the case of KNR, implementation of recommendations made regarding loading, sampling, grouping and unloading to 20% of the coal traffic now carried on KNR would save 330 cars or about 10% of the total fleet required for shipment of coal. There would also be other savings in yard construction and railroad daily operations.

5. Because of the nature of many of the problems (e.g. the closure of small mines) and because of the interdependence of all parties concerned 1/ with the problems of coal traffic, the consultants recommended establishing a coordinating body with authority to deal with the recommendations of their report and the carrying out of further studies if necessary.

6. Little or no implementation of the consultants' recommendations has yet taken place. Coordination should be the responsibility of the Government and the chief coordinator should be a senior Government official of the EPB which appears to be the department most suited to deal with this matter.

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1/ Coal mines, briquet manufacturers, City of Seoul, KNR, Government agencies.

October 15, 1969

ANNEX 8

KOREA

THIRD RAILWAY PROJECT

Items to be Financed by the Proposed Loan/Credit

1. Fifty 2500-3000 hp diesel locomotives required to handle the increasing traffic until electrification of the heavy loaded coal and cement lines is completed, and then to help in the phasing out of steam. They will also be useful for emergency operations on the electrified lines in case of power failures, and for handling high speed passenger traffic on the Seoul-Pu San line.

2. Some 2,740 freight cars, of 50- to 70-ton carrying capacity, consisting of 140 flatcars (of which 40 are for container operations), 200 ore-hopper cars, 200 bulk cement cars, 100 ballast hopper cars, and 2,100 general purpose cars (including box cars, gondolas, flat cars). All these cars are urgently required to deal with forecast increases in specific traffics, based on production and consumption projections, or to relieve current capacity deficiencies.

3. Telecommunication equipment, dealt with in detail in Annex 5. The actual equipment to be procured will depend on the result of consultant's studies.

4. Track maintenance equipment consisting of: (i) a track inspection car performing a geometrical check of the track under loan, for the guidance of management in planning and for overall safety of operations. This car will enable KNR to carry out two checks a year on trunk lines and one check a year on all other lines; (ii) equipment for double and single-track operations (4 multiple tie tampers, 3 ballast regulators, 3 ballast compactors, 1 ballast cleaner); (iii) various machines to speed up work (80 power wrenches, 174 band-held tampers, 72 four-headed tie tampers, 30 rail drills, 33 gang motor cars and 51 trailers) and (iv) 5 portable rail-crack detecting devices.

5. The services of consultants: (a) to examine KNR's telecommunication requirements in coordination with the Ministry of Communications' plans; and (b) to study the problem of diesel motive power maintenance, to review the position of workshops, and to assist KNR in evaluating the bids for procurement of the above mentioned diesel locomotives and track maintenance equipment.

February 24, 1970

KOREA

THIRD RAILWAY PROJECT

Economic Benefits and Methodology

## Freight Cars

1. The traffic forecast for the period 1970-72 cannot be transported by rail unless new freight cars are urgently acquired. Because of freight car shortages, KNR has consistently rationed their availability to shippers, resulting in the loss of large volumes of traffic. The proposed loan/credit would finance 2,100 general purpose, 200 ore hopper cars, 200 bulk cement cars and 140 flat cars, 40 of which are for containers for general cargo and 100 for the hauling of timber, construction material, etc. Also included are 100 ballast hopper cars whose justification is provided in item 4 below. The freight cars included have a total cost of US$28.4 million and are of 50-70 ton carrying capacity, while present cars average 35 tons. If these new cars were not purchased, the result would be a diversion to coastal shipping of most of the additional traffic at substantially higher costs. The hauling of coal and cement from the Northeast area to the Seoul area, for instance, involves a distance of 950 km by ship between the ports of Mug Ho and In Cheon plus the land movement from the mines and plants to Mug Ho and from In Cheon to Seoul as compared with a direct haul of about 310 km by rail. For this traffic the total transport cost is estimated at Won 1,060 per ton by rail and Won 2,050 per ton by ship. Analysis suggests that rail cost, as compared with coastal shipping haulage costs, results in net savings of Won 5.5 billion per year. These benefits do not increase as the cars will be fully utilized immediately after they are put into service. All of the incremental railroad costs in order to haul the freight cars are included in the economic justification; i.e. ground facilities of electrification, motive power and handling facilities. The freight cars are well justified with an economic rate of return of 26% over their useful lives.

## Diesel Locomotives

2. The 50 diesel locomotives to be purchased under the project with a total cost of US$19.5 million (including US$2 million for spares) are required to enable KNR to handle the increase of traffic expected during the 1969-1971 period. The purchase of powerful diesels (2,500-3,000 hp) would make it possible to cope with the difficult grades frequently encountered on the KNR system and increase the size and speed of trains, thus expanding KNR's carrying capacity. After electrification of the north-east lines is completed in 1973, the diesel locomotives provided under this project would permit the redistribution of existing smaller diesel units to shunting duties, thus replacing the last remaining steam locomotives. Economic benefits are represented by the savings in total transport costs as a result of carrying additional traffic by rail, avoiding its diversion to coastal shipping, during the period 1970-1973. With

the same methodology applied to freight cars in item 1, the rate of return on the investment would be 25%. After 1973 and throughout the useful life of the new locomotives, the benefits will arise from savings in maintenance and operating costs of the replaced steam locomotives amounting to a total of W 927 million per year. The rate of return would be 15%. The average rate of return would be about 16%.

Telecommunication Equipment

3. An adequate, efficient and reliable communication system is essential for KNR's operations and management. The equipment to be secured under the project, costing a total of US$2.6 million, will replace obsolete and deteriorated installations, some of which are over 60 years old. The present old equipment requires expensive maintenance, and interruptions of service due to failure are frequent. The microwave or coaxial system to be provided would replace the present open wire lines along the trunk route to Pu San and would provide additional capacity to meet the increased demand of communications associated with the traffic growth. The economic benefits of the new equipment as compared with the present equipment are represented by savings in operation and maintenance, amounting to US$285,000 per year. As compared with the investment and operating cost of replacing and expanding the present system, the additional investment in proposed equipment yields a rate of return of 17%. A different approach to the economic justification of the microwave/coaxial system, assuming KNR used long-distance public telecommunications services instead of its own equipment, shows that annual costs of KNR would amount to about US$700,000 per year as compared with the cost of the same service with own equipment. This represents a rate of return above 23.4%.

Track Maintenance Equipment

4. To adequately maintain KNR's way, modernization of present maintenance operations is required. The project would provide equipment at a total cost of US$3.4 million (including 100 ballast cars) that will allow a substantial reduction of the labor force in the maintenance gangs and will perform a better quality work on the track. At the moment 4,350 workers are employed on maintenance, representing a ratio of .8 man per track/km. This is a very low ratio (Japan 2.1, Italy 1.56, France 1.03) and KNR is going to increase it to 1.3 over a five-year period by employing almost 7,000 men if the equipment is not purchased. With the new equipment, annual savings in labor cost would increase from Won 120,000 to Won 2.4 million over the useful life period of 9 years. The investment on the equipment yields a rate of return of 32%.

March 3, 1970

KOREA

THIRD RAILWAY PROJECT

Tariff Structure

1. Freight Rates

Until May 19, 1969, there were three classes for carload freight (accounting for over 90% of all freight) as follows:

Class 1 - W 121.30 per ton for each 50 km = W 2.42 per ton-km
Class 2 - W 80.75 per ton for each 50 km = W 1.62 per ton-km
Class 3 - W 57.65 per ton for each 50 km = W 1.16 per ton-km
There is no taper for long distances.

There are also three classes for less-than-carload traffic, the rates per 100 kg for each 50 km being:

Class 1 - W 28.85 = W 5.77 per ton-km
Class 2 - W 23.55 = W 4.71 per ton-km
Class 3 - W 21.40 = W 4.28 per ton-km

On May 20, 1969, the three carload classes were expanded to five, the existing classes 2 and 3 becoming new classes 3 and 5, together with a new class 2 (W 98.00 per ton/50 km or W 1.96 per ton-km) and a new class 4 (W 66.30 per ton/50 km or W 1.33 per ton-km).

The main changes were: cattle and gasoline moved from class 2 to class 1; ores, fertilizer, bricks, timber, salt and grains moved from old class 3 to new class 4; and cement and fruit and vegetables moved from old class 3 to new class 3.

Coal remains in the lowest class (new class 5) but the minimum charge is W 3.460 per 30-ton car which is equivalent to a minimum distance of 100 km for a fully loaded car. Thus, the average revenue earned per ton-km by coal is about W 1.40 as against the class 5 nominal figure of W 1.16.

The main items in each class now are:

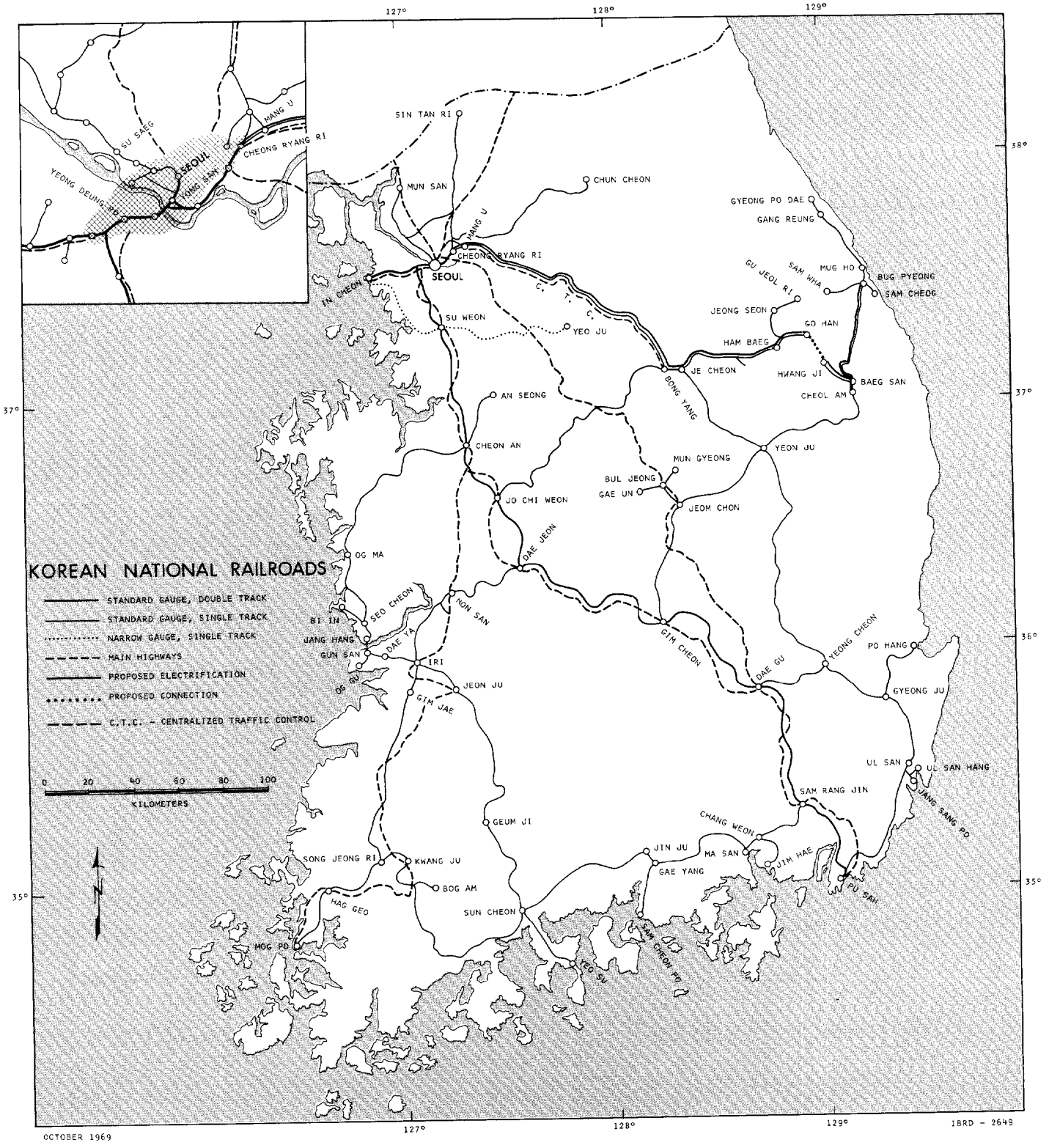
Class 1: Gasoline, Cattle, Textiles, Clothing, Furniture, Meat and Dangerous Goods (the latter plus 10%);
Class 2: Sugar, Cotton, Plywood, Hardboard;
Class 3: Cement, Diesel and Bunker Oils, Fruit and Vegetables;
Class 4: Lumber, Rice, Grains, Salt, Fertilizer, Limestone, Ores, Bricks, Pulp, Asphalt;
Class 5: Coal.

## 2. Passenger Fares

There are three classes of passenger fares averaging W 3.66, W 2.44 and W 1.22 per pass-km. In addition, there are surcharges for travel on various express trains and for sleeper berths. In addition to these fares is a "traffic tax" of 10%, reimbursable by KNR to Government.

Substantial reductions, imposed by Government, are granted to teachers and students (30%), armed forces and police (50%) and to student commuters (70%), but traffic in these categories is not significant.

October 15, 1969


KOREAN NATIONAL RAILROADS
STANDARD GAUGE, DOUBLE TRACK
STANDARD GAUGE, SINGLE TRACK
NARROW GAUGE, SINGLE TRACK
MAIN HIGHWAYS
PROPOSED ELECTRIFICATION
PROPOSED CONNECTION
C.T.C. - CENTRALIZED TRAFFIC CONTROL
0 20 40 60 80 100
KILOMETERS
N
127°
128°
129°
38°
37°
36°
35°
SEOUL
CHEONG RYANG RI
SIN TAN RI
MUN SAN
CHUN CHEON
GYEONG PO DAE
GANG REUNG
MANG U
SU SAEG
YEONG DEUNG PO
YONG SAN
IN CHEON
SU WEON
YEO JU
C. T. C.
GU JEOL RI
SAM WHA
MUG HO
BUG PYEONG
SAM CHEOG
JEONG SEON
GO HAN
HAM BAEG
JE CHEON
BONG YANG
HWANG JI
BAEG SAN
CHEOL AM
AN SEONG
CHEON AN
YEON JU
MUN GYEONG
BUL JEONG
GAE UN
JEOM CHON
JO CHI WEON
DAE JEON
OG MA
SEO CHEON
NON SAN
BI IN
JANG HANG
DAE TA
GUN SAN
IRI
GIM CHEON
DAE GU
YEONG CHEON
PO HANG
OG GU
JEON JU
GIN JAE
GYEONG JU
UL SAN
UL SAN HANG
JANG SANG PO
SAM RANG JIN
GEUM JI
CHANG WEON
JIN JU
MA SAN
JIM HAE
GAE YANG
PU SAN
SONG JEONG RI
KWANG JU
BOG AM
HAG GEO
SUN CHEON
MOG PO
YEO SU
SAM CHEON PO
OCTOBER 1969
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